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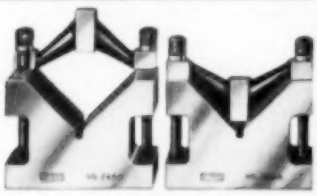

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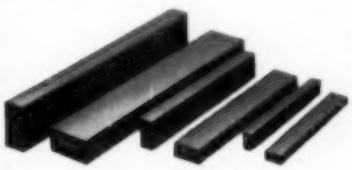

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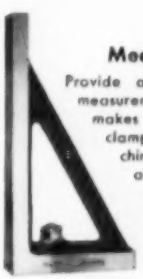

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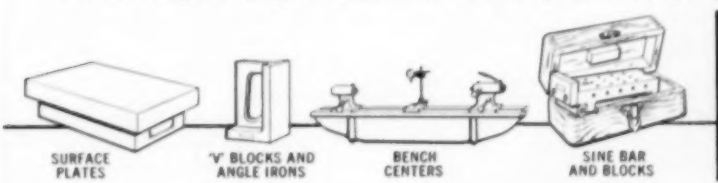

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RESOLUTION

by the Officers and Board of Directors of the American Society for Quality Control

on the death of

CHARLES DEERE WIMAN

WHEREAS, It is with profound regret that we record the death on May 12, 1955 of Charles Deere Wiman, friend and member of the Advisory Council of the American Society for Quality Control; and

Whereas, We have long known, admired, and respected Colonel Wiman's unbounded enthusiasm and willingness to give unsparingly of his time and effort to furthering the objectives of the Society, and because his memory is a worthy inspiration for all members of the Society; therefore, be it

Resolved, That in behalf of the entire membership of the American Society for Quality Control, the Officers and Board of Directors express their feeling of great loss, and extend to Mrs. Wiman their heartfelt sympathy; and be it further

Resolved, That this resolution be recorded in the permanent minutes of the Society, that it be published in ***Industrial Quality Control***, and a copy be transmitted to the family.

May 24, 1955

Continuous Process Control In a Petroleum Refinery*

JOHN T. WALTER

University of Pittsburgh, Pittsburgh, Pa.

Statistical quality control in a petroleum refinery calls for a technique to control the continuous stream type of process. The principles involved also have application in large chemical plants and wherever there are extensive fluid operations.

An experiment was carried on in a large refinery over a period of several months, and the indications were that statistical control of a continuous fluid process can reduce the variability of product quality considerably. In these terms statistical quality control is a demonstrated success.

The project was initiated as a result of examining sampling schedules for a refining unit. These schedules were originally established to satisfy the demands of conservatively minded operating men by calling for regular and frequent sampling. Attempts at economy in laboratory operation exerted a pull in the other direction, looking toward longer intervals between samples. In an effort to resolve this conflict and to establish acceptable standards of sampling frequency, applications of statistical quality control were investigated. It was assumed that a process operating in statistical control is a prerequisite to determining optimum sampling schedules.

Fractionating Tower Used

The unit selected for experimentation was a fractionating tower with an average daily run of 62,000 barrels. The top stream coming off this tower turns out 20,000 to 23,000 barrels per day. This was the stream chosen. Product samples were drawn from the line at eight-hour intervals.

Ready-made procedures could not be found in the literature of quality control. At the most, hints were given that helped to point the way in the right direction. In fact, during the 1940's some academic and industrial statisticians were known to have said that statistical quality control had no place in the chemical industry. Owen L. Davies, in his *Statistical Methods in Research and Production with Special Reference to the Chemical Industry*, 1949, says of quality control, "Its application in the wider field of the chemical industry is still a matter of some doubt, but in view of its striking success in other fields, it is felt that the possibility of its application to chemical plants should receive careful consideration."

As recently as February, 1953, L. J. McGovern, writing in *Petroleum Refiner*, said that to his knowledge there have been no successful direct applications of statistical quality control to petroleum processing units. He said further, "The development of this approach is still on the drawing board." Thus, it can be seen that pioneering activities were necessary in the year of 1953. A start was made with only the assurance that no harm could result from the attempt.

Improved quality control presents other than technical problems. Some operating men, long accustomed to established procedures and having a conservative attitude toward their work, are slow to accept new ideas. It is only natural that people take pride in what they have done for a long time. Unfamiliarity may also cause resistance to develop when new terms are introduced from the field of statistics.

Obtaining Samples

The usual average and range charts require modifications when applied to a continuous stream. In metalworking industries five or ten samples at a time may be taken off the assembly line for inspection to determine their average quality. It is meaningless to average several samples drawn at one time from a fluid product stream. Fluids are homogeneous in nature, so each sample will be the same as another. Such averages would not be sampling averages. They would represent an averaging of laboratory test results, tending to eliminate measurement error. In this event, product quality is not being averaged by the statistician. Averaging becomes instead a chemical reaction.

To get a sampling average it is necessary to take the samples at different periods of time. If the intervals between samples are short, it comes close to being like the situation where two or more samples are drawn

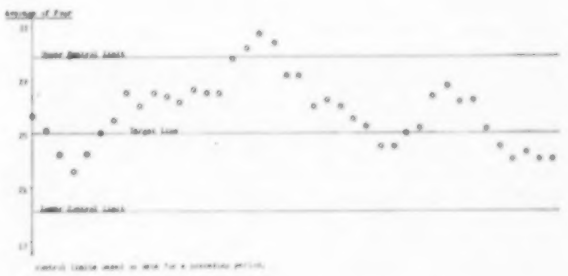

Figure 1—Control Chart (Moving Average of Four)

*This article appeared first in the 1953 Rutgers Conference Proceedings. It was subsequently published in the February 1954 *Petroleum Refiner* and by their permission in the 1954 ASQC Convention Papers book. It is re-published here in slightly revised form by permission of *Petroleum Refiner*.

Figure 2—Individual Samples (Moving Average Control Chart Used)

Figure 3—Moving Range of Two (No Control Chart Used)

simultaneously. If they are farther apart, one is forced to wait some time after taking the first sample before final reports are forthcoming. This delay may be too long to satisfy operating requirements.

A chart of individuals gives quick results, but with certain other disadvantages. It lacks the smoothing effect of an average chart (Figs. 1 and 2 present the same information in both forms.) This smoothing out of short-term fluctuations permits more careful determination of the real process level. In addition, laboratory analytical error creates more uncertainty for any single sample than for an average of several samples. To say the same thing in another way, multi-testing increases the reliability of laboratory tests. Sampling error is affected in a similar way.

As a compromise between the chart of individuals and the chart of averages, a moving average was plotted. This seems to combine all the advantages of the average with some of the desired sensitivity to change. It even smoothes out the curve more than an average does. While not quite so responsive to change as the chart of individuals, it is, perhaps, desirable not to be. On the other hand, the moving average does respond to each new test result incorporated into the average. Basically, the average chart is the guide to process level, while process variability can be better portrayed by a chart of ranges or standard deviations, a moving range of two samples being useful (Figs. 3 and 4.)

How many samples should be included in the subgroup for the moving average? This is a debatable point. In the experiment under consideration a moving average

TABLE I—Data for Figures 1 and 2

	Final Boiling Point	Moving Av. of Four		Final Boiling Point	Moving Av. of Four
1	..	26.3	21	32	29.3
2	20	25.3	22	24	27.0
3	25	23.5	23	28	27.5
4	20	22.3	24	24	27.0
5	29	23.5	25	28	26.0
6	26	25.0	26	22	25.5
7	29	26.0	27	22	24.0
8	28	28.0	28	24	24.0
9	25	27.0	29	31	24.8
10	30	28.0	30	24	25.3
11	28	27.8	31	32	27.8
12	26	27.3	32	27	28.5
13	29	28.3	33	26	27.3
14	29	28.0	34	24	27.3
15	28	28.0	35	24	25.3
16	36	30.5	36	22	24.0
17	32	31.3	37	22	23.0
18	33	32.3	38	26	23.5
19	26	31.8	39	22	23.0
20	26	29.3	40	22	23.0

of four was used. Averages of four are statistically more effective than averages of two or three. Distributions of averages of four or more tend to be normal, while the larger averages have less sensitivity to change.

Control limits are established in much the same way as in other kinds of quality control work. However, since there is no rational subgroup basis for computing ranges as a measure of process variability, the alternative is to form groups out of samples taken in consecutive order. From 25 to 50 groups are used. Factors from published tables of multipliers may be applied to the average range to get the desired control limits.

It is reasonable to look for some improvement when the chart is first installed, not knowing how much improvement can be made, of course. In the experimental project an arbitrary squeeze was put on the control limits by starting with 80 percent rather than 3 σ limits. Success in staying within these limits proved the decison to be justified. Later 3 σ limits were used, but by then these revised limits were about as narrow as the original 80 percent limits.

The Critical Control

Final boiling point on a distillation test was the critical control. Prior to beginning statistical quality control the process had a standard deviation of 6.2 degrees over a period of 15 weeks. Then, for a ten-week period a control chart of individuals was used with a standard deviation of 5.0 resulting. Finally, a moving average control chart applied over a period of nine weeks produced a standard deviation of 3.1. The moving average reduced variability to one-half of what it had been without statistical quality control (Fig. 5.) These gains were made without using a range chart, showing the effectiveness of a chart of individuals and then of a chart of the moving average uncomplicated by other considerations.

Figure 4—Moving Range of Two (Moving Average Control Chart Used)

Reduction in variability of the product stream has several consequences. The immediate objective is to attain a desired cut point. This ultimately becomes a question of meeting customer specifications with greater accuracy, avoiding some degree of former quality give-away. When applied to intermediate stages of production, statistical quality control means less difficulty with subsequent operations as a result of stabilizing their feed. In the fractionating tower itself adjoining streams will have less variability as a result of stabilizing the one stream.

In other industries statistical quality control has made it possible to abandon 100 percent inspection without any sacrifice of quality. There is no such thing as 100 percent inspection in a continuous fluid process, but the amount of inspections can be less with statistical quality control than without control. During the course of the experiment it was possible on two occasions to test more than 60 samples without making a single process adjustment. In the state of statistical control that this condition represents, fewer samples could have been taken without disadvantage. Twenty samples would have served as well as 60, or one per day instead of one each shift. The laboratory reports that a reduction of two samples a day would mean a saving of about $3000 per year in laboratory costs. Any such reduction is feasible only while the process is in control. Special samples are required more frequently during an upset.

Try Different Arrangements

It appears as though the only way to determine the right number of samples is to try different possible arrangements and judge by the results. This calls for some boldness on the part of management. Fear has been expressed that less frequent sampling may conceal an upset beyond the time when it would otherwise be discovered, with losses so great as to overshadow the savings from sample reduction. A cursory examination of some of the records raises the question as to whether distillation tests do not have their greatest usefulness in determining the process level, while other indicators serve to reveal upsets. Apart from unusual disturbances, it appears that control is not improved by frequency of sampling. In fact, the indications are that plant operators made too many process adjustments when not in statistical control, and actually improved control by adjusting less frequently (Fig. 6.) This is one of the benefits of using the moving average chart. By smoothing out the curve the frequency of adjustment is reduced.

Statistical control of laboratory testing procedures is another application of the general technique (Fig. 7.)

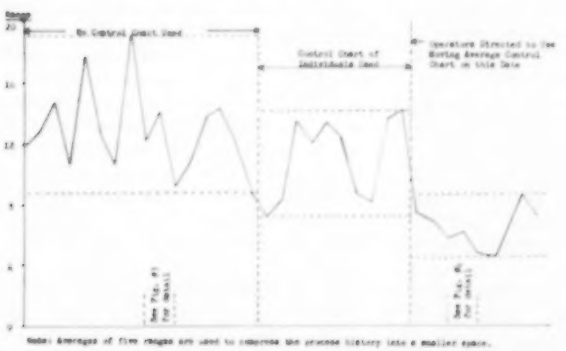

Figure 5—Averages of Groups of Five Ranges of Four Samples (Dotted horizontal lines enclose the high and low points for each period used)

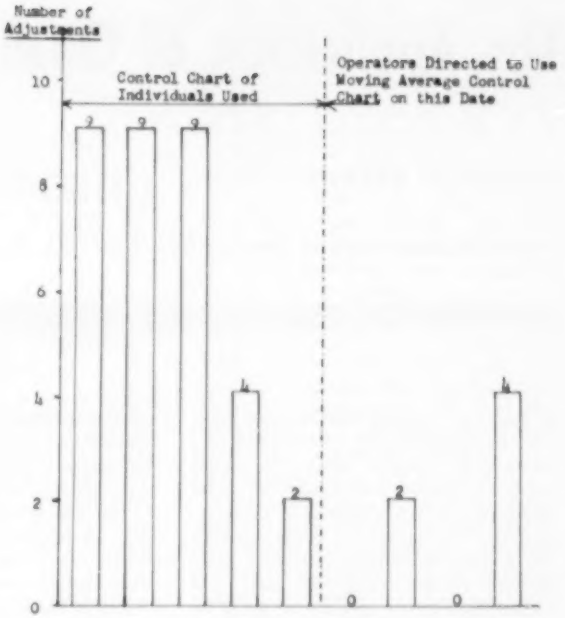

Figure 6—Process Adjustments Per Forty Samples)

Figure 7—Laboratory Control Chart (Range of Duplicate Tests on Routine Samples)

Petroleum process control is dependent upon laboratory test results, and it follows that smaller laboratory analytical errors will mean improved process control. Periodic determination of testing error is a part of good laboratory management. Education of personnel or other steps toward improvement should be undertaken as soon as these investigations reveal where problems exist. The best approach is to use statistical control charts in the laboratory. This helps bring the laboratory procedure into control and is the means of maintaining control with the minimum of effort. Complete success with plant control requires this supplementary effort in the testing laboratory.

It is important to know what to expect from quality control. Control charts are in no sense automatic in their operation. One cannot sit back and let the charts control the plant. Neither do the charts require much time and effort. The same amount of effort brings better results with statistical control than without. The statistical approach to quality control can be doubly rewarding where there was formerly neglect. Control charts are merely better tools capable of superior workmanship. Either with or without their aid, skillful operators get better results than careless operators.

The Application of Quality Control Techniques in Determining

SOLOMON BARKIN

Textile Workers Union of America, CIO, New York, N. Y.

Quality control techniques are being gradually introduced into the textile industry where operating controls are greatly needed. The existence of a multitude of interdependent variables has always made for highly unstable operating conditions in textile plants. But few sustained efforts had been made to stabilize them although many managements have sought to improve the general level of operations. Attempts to set work assignments, and to control the quality of products have brought managements to grips with the problems of variations. Yet the time study men responsible for setting job assignments have tended to dodge these problems and have avoided quality control techniques. Production managers have also taken negative attitudes and continued skeptically to insist on proof that controls pay off.

The time study men's failure to use quality control techniques for defining physical phenomena has created a gap between their claims for, and the results of, their work. While they claim to have been fixing stable equivalent levels of work application on all jobs, paying premiums for work above such levels, few have attempted precisely to define the level of expected performance of each quality precisely enough so that the actual level of the work demands could be ascertained. As a consequence, one necessary basic, though not the sole, change in time study theory and practice must be the adoption of quality control techniques to describe more accurately the jobs which these men construct for employees.(1)

Workers, like buyers of merchandise, have understood that they must protect themselves from vague definitions; they protect themselves from poorly defined job standards by demanding lower work assignments. Many serious industrial disputes arise from management's unwillingness to guarantee a specific set of physical conditions and the workers' desire to avoid excessive physical demands during periods of extreme job deterioration.

Quality grades in the merchandising of textiles and other materials have been introduced to eliminate speculation over the likely quality level of the goods being bought. The buyer of ungraded fabrics usually offers a lower than prevailing price for them to hedge against a higher than customary percentage of low grade fabrics. The absence of careful definitions of grades makes proof of quality difficult and the haggling over price has, therefore, to consider not only the economic value of the specific quality, but also the risks taken on the actual quality of the merchandise. The establishment of specific product grades has therefore been advantageous both to the seller and the buyer. Premiums paid for high quality have acted as an incentive to improvements. Grading has eliminated a risk from the buying process. The purchaser no longer has to hedge his price against this factor. Workers would also moderate their attitude toward many industrial problems if they were offered carefully defined statements of work conditions which were to be strictly maintained on a job.

To us in the textile industry where erratic work conditions are particularly prevalent, the establishment of controls is of prime importance in any procedure for work measurement. The quality and processing characteristics of the raw materials used in each process affect productive efficiency. The machinery is almost wholly automatic, continuously processing raw material until it either exhausts its supply reservoir, fills its delivery reservoir, or until material breaks or mechanical difficulties arise. Breaks may result from a number of causes, such as the characteristics of the original raw material, deviations induced by the prior processes, machine and operating difficulties, or worker handling. The worker's task is primarily that of loading supply packages for processing, removing the fully produced package or doffing, maintaining the machine and the cleanliness and orderliness of the room, and repairing broken strands in the material as it is processed to restore machine activity. Most significantly, the demands made on workers by any specific battery of machines will vary with changes in these factors and the frequency with which any specific service has to be performed. While some frequencies can be predetermined by management through scheduling, others (periodic duties) are related to the production cycle and the machine's efficiency is controlling. For still other frequencies (random duties) estimates can, at best, only be based on statistical studies of past experience.(2) But with the great likelihood of changes occurring in conditions, these data may become unrepresentative for future operations.

While a textile worker's assignment is characteristically rigid in terms of a specific stand of machines, the demands on him may vary widely from hour to hour and day to day. The very predominance of random work duties in job assignments makes for great uncertainties as to actual work requirements. Very often the work duties accumulate and the worker is simultaneously beset by many demands for service. A successful training program and good morale will instill that pride of job in workers which will make them intolerant of idle machines and drive them to restore the machines to production, thereby creating unusually high demands on them. But the continuance of such high pressures will tend to demoralize workers, create great dissatisfaction, and may also produce defensive indifference, and possibly, retaliation, a not unusual by-product of the time study man's activitiy in the textile industry. The

Work Assignments and Standards

destruction of the pride of craftsmanship through excessive work demands resulting from unstabilized job demands has also resulted in progressively poorer products and growing production difficulties.

While there are few industries where the merger of the techniques of quality control and time study is as essential as in textile, the latter is one in which the use of quality control procedures has been extended only slowly. Its full integration into the production and managerial processes is rare.

Few time study practitioners have undertaken a systematic description of the physical realities of an operation in the terms employed by the quality control analyst.

We in the trade union movement have been particularly conscious of the absence of such integration and have urged, through a publication entitled *The Textile Workers' Job Primer*, more extensive use of quality control approaches as a prerequisite to more intelligent bargaining on the size of the work task.[3] We want the worker, like the buyer of merchandise, to be relieved of the risks of uncertainties in the definitions of his job. The buyer has been guaranteed the quality of merchandise; the worker wants his task defined in terms of carefully itemized job demands with specific notations on the frequencies of duties to be strictly maintained within a prescribed range of variation.

Systems of Control in the Textile Industry

Work assignments must necessarily be related to the degree of stability attained on a specific job. To define stability, we must have tools for measurement and methods of recording the occurrences. To establish confidence in these standards, there must be a system of control which insures detection of departures and immediate correction of conditions causing such undesired variations. It is well to review the prevailing procedures in the textile industry, for then we shall be better equipped to determine the method of setting job standards best adapted to this industry.

Correction System

In any industry where manufacturing is still largely an art, and scientific information is limited, the primary reliance for operations must still be placed on the personal experience of the supervision. The production men are expected to follow the manufacturing operations, detect deviations, and correct them. Depending upon the individual's acumen and the conditions which develop, extreme failures are likely to be detected and efforts made to remedy them, particularly if they persist for a noticeable period. Special attention is likely to be paid to the characteristics of the final product, especially in times of a buyer's market, when products may be returned by the customer.

The procedure emphasizes correction of extreme departures from customary levels of variation, individually interpreted by supervisors. Correctives are applied with the hope that they, or other countervailing forces, will rectify the condition and restore the customary levels of variation. But actually, the range is not known or defined, and can vary widely from person to person, machine to machine and from time to time.

In such plants, managements in the past, may have tried to shift the onus of bad results to workers, by imposing fines, partly with the hope of thereby enlisting the workers' efforts in the detection and correction of bad conditions. Unfortunately, workers in most cases could not identify the trouble and frequently found their suggestions unwanted and rejected. Under those circumstances, workers have not only had to work harder to overcome defective conditions, but have suffered drops in earnings from reduced machine efficiency and also have had pay deducted for the lower quality output. Fortunately, union pressure and a higher sense of managerial responsibility have combined to eliminate these penalties.

Workers have responded to these conditions with various defensive practices. A common one is to demand an organized system of preference or equal distribution of jobs to assure either better treatment for the senior employees or equal distribution of jobs among the employees. Another reaction has been to insist upon low enough assignments so the job will remain tolerable even in the face of the most serious deterioration of operating conditions.

The correction systems face their severest tests during periods of intense competition when management seeks to extend assignments to meet competitive costs, but refuses concurrently to guarantee job conditions. Plants operating with such systems cannot provide responsible calculations for work assignments.

Prevention Systems

Many mills have advanced beyond the above system by instituting standards for the purchase of raw materials or for the operation of specific parts of their manufacturing processes, such as room and machine conditions and settings. Management, either on the basis of specific studies, or its own experience or that of others, determines the conditions and settings likely to yield the best operating results and the desired product quality. These then are followed in the purchase of the materials, the operation of the mill and the location of production facilities.

A prevention system represents a marked advance in textile operations, since it defines management's responsibilities for supplying specific materials, machines and surroundings. Departures from standards set in these areas may be carefully evaluated and brought into line. Each specification can be tested for its appropriateness and revised as knowledge improves or experiences dictate. Some mills have not only set up such specifications and followed them in practice, but have also instituted careful systems for checking the degree of conformance of actual conditions to these standards. The most advanced development in this area is the institution of a preventive maintenance program providing for the regular examination of machine parts and conditions and replacement of machine parts not meeting

the specification, even though they have not affected production. This preventive attitude contrasts strikingly with the emphasis on simple correction previously outlined.

While the above practices are likely to reduce variations, they do not provide a definition of the range of permissible variations or a careful program for evaluating or controlling them. They begin with the assumption that if conditions are properly set, an absolutely stable population of variable values can be maintained on a long-time basis. This position is unrealistic in the textile industry. Each fibre is unique and its processing characteristics cannot be easily predicted since they will fluctuate continuously. Machine and room conditions are constantly changing under the influence of such factors as handling and atmospheric conditions. Full implementation of this preventive technique would require precise knowledge of the effects of each of the possible values of the other variables and their myriad of combinations. Such knowledge is unavailable and is not likely to be manageable. Invariable conditions cannot be maintained.

This prevention, therefore, neglects to treat variations in actual results. It uses averages as standards without nessarily taking into consideration the fact that two equivalent averages may represent completely different basic distributions of values with consequent diverse demands upon workers. The supervisory official using such specifications often becomes so imbued with a feeling of their appropriateness and infallibility as to be completely deaf to considerations of the meaning and effect of variation. Managements following this technique often uncritically lend themselves to the use of the current time study practice, without appreciating its failings as a measuring tool in a textile mill. Work assignments are likely to be set more tightly and rigidly in such mills, with few concessions to the actual variations in conditions developing on the job. Only in the case of extreme departures from customary operations, recognized either by the worker or the management, will corrective steps be taken.

Checking Systems

A number of companies have made a further advance by instituting systems for checking both the frequency of random occurrences such as yarn breaks and loom stoppages, and other variable operating conditions like bobbin weights, machine speeds, package weights and product characteristics such as neps and strengths. The ojective is to test conformance of the average of these qualities with a standard rather than to measure the range and nature of the deviations.

These tests for conformance to standards are seldom precisely defined. First, samples are not systematically obtained; the sufficiency of their number is not determined; the adequacy of the size is not evaluated. Second, the degree of conformance is seldom, if ever, prescribed. Third, the range and nature of the dispersion are not regulated. The checks tend to be sporadic.

The procedure flows from concepts existing in the prevention system which seeks to enforce given specifications. The aim is to approximate a standard rather than to assure stability.

Quality Control Techniques

Unlike the preceding, the quality control techniques utilize not only specifications for purchasing the proper materials, setting the appropriate conditions and checking on operating conditions, but also prescribe procedures for checking deviations from standard operating conditions, product qualities and results. The quality control man, in collaboration with the manufacturing engineers, supervisors and the laboratory technologists, determines objectively the extent to which prevailing variations in both mean values and dispersions about means can be attributed to chance or to specific causes. Specific disturbances creating unusually erratic behavior can be isolated and corrected. After they are eliminated, the quality control techniques are used to maintain specific levels of performance and ranges of variations, and help in the improvement of the level and the narrowing of the range through careful study of the information obtained on the control charts. Most important, the quality control system presupposes continuous, permanent and representative checks on performance and therefore reflects management's acceptance of its responsibility for maintaining standard and stable conditions.

A quality control program for a textile mill must include: (1) the study of stock characteristics to secure stable mixes and provide immediate guidance to the operating staff on the nature of the changes in stock mixes as they develop, particularly in respect to the natural fibres, but to some extent also with synthetic fibres; (2) the checking of room and machine conditions for conformance with permissible ranges of variation or for replacement; (3) the checking of actual machine speeds and settings as well as parts, for adherence to specifications and, where variations are permissible, for observance of the control limits on variations; (4) sizing of the products at each step in the process, to determine whether the weights are stable and conform to specifications; (5) the control of the degree of linear regularity or evenness of the product within prescribed limits and other product qualities.

In addition to the above program of control of conditions and products, it is also necessary to have specific information on factors directly affecting the work demand. Averages and ranges of package weights, for example, directly affect the frequency of some periodic work duties; and the frequencies of material breaks or machine stoppages materially determine the work required of the attending employees. The measures must, of course, be directed not only to checking the mean frequency, but also the variations in the frequency, thereby permitting determination of the degree of conformance with the control limits.

The institution of a complete system of quality control provides a realistic basis for testing the level of performance and also the degree of observance of the control limits. It is the only control system which provides specific control limits. As such, it offers a definitive basis for calculating work assignments. The other approaches to control base their estimates on standard frequencies ignoring the effects of the higher frequencies. The use of the quality control technique makes it possible to set a ceiling on work demands and to use this ceiling as the critical determinant in the formulation of work assignments.

This approach—using upper control limits rather than average levels of job demands—has been recognized as basic to the realistic application of time study technique by arbitrators. Practitioners have, unfortunately, continued to ignore these findings. One decision, in the automobile industry, held that the job level which the management can claim as standard is the upper limit above which the worker cannot be expected to apply himself. Management could not, the arbitrator held, justify temporary operation of the assembly line at above standard

speed merely because the line had been stopped part of the previous hour and it wished to maintain the established average output for the shift.[4] This conclusion has been reinforced by other arbitrators dealing with piece rate jobs in other industries. In textiles, arbitrators have held that the workers' negotiated hourly rate is exactly what the term implies, a minimum hourly floor. Bonus earnings accruing in any single hour may not be used to make up pay because the worker fails to earn his guaranteed minimum during another hour. Each hour must be tested separately.[5]

The trade union movement has, therefore, increasingly favored the use of the quality control technique for the definition of work demands, because it presents the limits of permissible variations, usually referred to as control limits. It is a technique, acceptable to both advanced management and workers, for defining measures and limits of frequency. It provides a scientific guide for the operation of sampling procedures to secure representative results, and control charts to inform management automatically when conditions deteriorate to the point where control limits are exceeded and corrections are imperative. With the use of quality control techniques, management is adopting a procedure for calculating job assignments in terms of actual rather than supposed job requirements and in a form which automatically carries with it the responsibility for maintaining these conditions.

Organizing a Mill for Quality Control

The institution of a complete system of quality control represents a radical alteration in managerial methods. It constitutes the substitution of definitive measurement for rule-of-thumb hunches. Evidence, rather than mere hearsay, is more likely to be used in such programs in the development of specifications, standards and control limits. Secondly, it means the systematic recording and formalization of production practices. Thirdly, it results in the close coordination of the laboratory, testing officials, production supervisors and management. This latter objective will be most difficult to attain and many a program has foundered on this rock. To operate the program effectively the management must not only accept the theory of control and have the conviction that it is economically sound, but it must also be competent to handle the techniques and master the meaning of the charts and results. It must also have the determination to accept and act on the warnings sounded and the conclusions suggested by these charts. Policing the control limits and enforcing their meaning becomes critical both for the operation of the mill and the worker. Unless these control limits are used strictly and automatically, the entire procedure deteriorates and becomes useless as an approach to the determination of work assignments.

There are few mills in the textile industry which have a complete integrated system of quality control to regulate stock, machinery, settings, sizing, linear regularity, package sizes, product qualities and random element frequencies. Some progress has been made, particularly in the measurement of raw materials, sizing and linear regularity. But even with respect to these items, few maintain complete control systems.

Too many managements assume that, in view of our lack of knowledge of many phases of the industry, wide variations and instability are inherent. Only recently, as new measuring instruments have been developed, have specific tests become frequent. But they have seldom been integrated into a complete control system. Most managements have resisted the costs and remained skeptical of their relevance to the determination of work assignments or to the lowering of manufacturing costs.

The Time Study Man's Views

Before evaluating the effects of the preceding discussion upon the methods of determining work assignments, it is necessary to describe the time study man's approaches. His failure to assimilate the significance of quality control techniques for his problems stands in the way of reducing this area of controversy between management and labor and developing a satisfactory procedure for calculating work assignments.

The fundamental inclination of the time study man is to eliminate all job complexities from his calculation so that they may be easily made. Variables in frequencies are dismissed by the use of averages obtained through haphazard and unchecked sampling techniques. He blinds himself to the fact that an average is, at best, a summary description of a distribution of values and is hardly an adequate description of the entire distribution. He makes the convenient assumption that the selected figures would be an invariant absolute. His glib answer to those who point out that deviations occur constantly is that they will be averaged out, hoping his response will not be tested by a trade union before a careful arbitrator or responsible and informed management.

The fundamental data used by time study men to obtain their representative figures are seldom built upon careful sampling procedures. Usually they are derived from sporadically conducted observations of varying duration. Sometimes, tests are made to satisfy a management's curiosity or a worker's grievance or because observers are available. Seldom are they made on a thorough and continuous basis. The acme of scientific inquiry usually is represented by the pretentious concession that the results should be built on full shift counts of highly variable frequencies such as end breaks or other random occurrences. But no such test can be representative of any conditions except those being studied, and then only if the range and character of the dispersion are also noted. Time study men often contend that the procedure of making eight-hour studies is "better than sampling." They fail to realize that the eight-hour studies are merely samples for an infinite population of shifts. The fundamental fact is that they are unwilling to acknowledge the presence of uncertainties associated with all sampling and the need for defining the extent of the variations. They cling to the concept that they must deal with fixed absolute average values. They have no place within their system for the concept of confidence limits.

Happily, arbitrators are beginning to enforce a more realistic approach upon time study practitioners. They are beginning to accede to union requests for a more thorough analysis of the data underlying time study summaries, which is proving most enlightening. Arithmetic means built upon a very limited number of observations encompassing wide ranges of variation have been rejected. Data purporting to be representative, when the probability of the observed mean being within plus or minus five percent of the true population is not very high, have been held to be meaningless.[6]

While these awards are encouraging with reference to their effect on the sampling procedures themselves, they have not inculcated time study practitioners with the importance of

tailoring standards to the type of data employed to build them. Appreciation of the pronounced difference between variables and absolute constants has never been grasped by most practitioners.

The assumption of absolutes leads the time study man to believe that a job standard is a stable fact, requiring little policing or review. Despite the protestation that time studies are necessary to insure a correspondence between pay and application, they abandon the strict enforcement of this conviction in the administration of standards. There is no procedure for self-administration of a standard to insure that changes in labor requirements will bring an automatic correction in values. Changing frequencies do not immediately result in new values, for that represents too complex a challenge for current time study men to deal with. They would need an elaborate system of control over work duty frequencies, as provided by quality control engineers, which they are not prepared to insist upon, as a necessary prerequisite to their own operations. They prefer rather to dismiss the entire problem with the consoling belief that an average is a representative figure which irons out differences. Various allowances are added to the job standard to take care of the unusual factors.

These views offered in defense of the time study man's practice have, of course, made him the object of increasing attacks on many grounds. Many of us have wondered how the practice has been able to maintain its hold in face of these onslaughts.[7]

The Use of Quality Control Techniques in Work Assignment Determination

The current procedures for setting job standards and assignments require substantial overhauling. Not the least significant change is the one needed to assure a closer relation of the assignment to the level of actual physical stability prevailing on a job. The level and dispersion of the frequency of work duties must be clearly known before assignments are made. Certainly, there must be a procedure for correcting assignments and work standards when they seriously depart from assumed levels.

To achieve this end wider use must be made of the concepts underlying the quality control techniques. The frequencies of work duties or elements must always be described in terms of standards and the range of permissible variation, with the latter corresponding to the usual control limits in the quality control charts. The actual standard frequency must correspond either to the outer limit or should be close to it as it represents the maximum demand made on the worker by the particular work duty. When frequencies exceed these limits, obviously substandard conditions must be declared to prevail, and these circumstances must be dealt with in the manner in which all substandard conditions are handled under a specific collective bargaining agreement.

The use of this approach to the problem of work assignment determination will also provide an additional incentive to management to attain not only higher levels of performance but also a narrower band of variations on a specific job. The time study technique is in practice unable to provide realistic adjustments of this type.

The TWUA Research Department has devised another approach to the problem of work assignment determination which seeks directly to apply these concepts. The benchmark or model job procedure builds upon collective bargaining concepts. Management and the bargaining agent agree upon the use of an actual job as a guide or model for the determination of all subsequent assignments on the same operation. In practice, after the parties have agreed upon such a benchmark or model job, it is described in terms of its major activities. Empirically determined conversion factors are employed to convert the frequency of each of the major activities into a single equivalent unit and the maximum permissible number of equivalent operations or activities which a worker can be expected to perform in any stated period such as two or four hours is clearly stated. While the job assignment is set in terms of the standard frequency of equivalent operations for the test period, a maximum frequency is also set as the ceiling beyond which the variation may not proceed without making the job substandard.

The above contribution to the art of job assignment determination has the advantage of defining the job completely in terms of demands made upon the worker and therefore conforms with the management's basic desire to set jobs in terms of identical levels of worker application. It not only acknowledges the principle but actually provides an automatic procedure for insuring the enforcement of the principle since the worker under these circumstances has a personal incentive and reason to keep a check and enforce the job standard. The procedure has another advantage in that it circumvents other deficiencies of the time study procedure such as its assumption of operational stablity, uniformity of motion patterns, ability to rate, the ability to project new jobs through the sum of allowances for the component parts of a job. Moreover, it provides a description of a complete job in terms of realistic physical duties and frequencies. Because these can be negotiated, many of the suspicions can be moderated and opposition to measurement dispelled. Moreover, it tends to favor the mills with the most stable operating conditions where the compatability of benchmarks and quality control installations are obvious. Both incorporate a philosophy which recognizes that variation cannot be eliminated merely by ignoring it and that it must be policed and appraised by continuous sampling. Mills employing quality control would find benchmarks particularly attractive as their technicians can devote themselves to narrowing the range of variation with the knowledge that success will be reflected in increased machine assignment and productivity. Cumbersome and expensive time study analyses which, even after trial installation, are frequently found unsatisfactory because the effects of variation, previously overlooked, often render forecasts inaccurate, can be eliminated. The high probable return per dollar invested in quality control in benchmarked mills provides compelling incentive for its adoption.

Conclusion

Conditions in textile mills are in constant flux, with results diverging from those expected to stem from the original raw material and machine setting specifications. Numerous variables are constantly affecting product characteristics and demands made upon the worker. Standards cannot realistically describe the job with single values. They must include in addition, a definition of the range of permissible variation. Only such definitive specifications will permit practical testing of conformance between standard and reality.

A major failing of the current time study techniques is the use of average values as absolutes. These inadequately describe the actual textile mill job demands. Jobs, therefore, are not being set in terms of actual work demands and improvements

cannot be effected until quality control techniques are implemented. Unfortunately, current time study philosophy is the direct antithesis of that underlying quality control. It is therefore particularly difficult to operate both plans in conjunction with one another in textile mills. Quality control, being scientific, cannot be altered to make it more palatable to time study advocates, who, unfortunately, are more firmly entrenched in management hierarchies. The latter are not especially prone to the acceptance of scientific techniques especially if they complicate observational and computational procedures. We have therefore offered an alternative approach in the benchmark plan under which jobs are defined in terms of equivalent operations which can be directly related to control chart recordings. Any work assignment appraising technique which relies upon evidence collected through quality control applications is more likely to produce realistic conclusions and reduce the frequency of time study bred work assignment grievances. A mutually agreed benchmark system of work assignment is the proper base for developing more satisfactory assignments in an era of collective bargaining.

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An Engineer Evaluates Statistical Methods

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It is not the intention of this article to present a learned evaluation of statistical methods, but rather to report a few instances of my discovery and use of techniques of statistical analysis which, while undoubtedly very familiar to the members of this society, have been a great revelation to me and of significant help in the performance of my work. Like many other engineers who graduated twelve or more years ago I did not have the opportunity to learn statistical methods of analysis in college and was forced to rely on what is generally called common sense or judgment in arriving at various conclusions. Tests of significance and perhaps more efficient design of experiments have given me increased confidence in my work.

Before proceeding any further, I should like to describe briefly my position in our organization and point out where statistical methods can be of help to us. I am in charge of the electrical engineering department whose function is to design new products, modify old ones and evaluate new material and methods as they become available. Our main products are ceramic and mica capacitors, composition resistors, and assemblies employing these and other electrical components. Because of the extremely rapid development in our industry, we are constantly working on a large number of new projects with the attendant development and evaluation of new dielectric and resistive materials, finishes, seals and manufacturing methods. This requires that we perform a great many tests and experiments and proper design and efficient evaluation can mean great savings in time and money.

Perhaps my first introduction to the great advantages of the application of statistical technique was from the examination of the records of our quality control department during the first year of its establishment. For a long time we had sampled incoming material and sorted our outgoing products, with records kept in not too systematic a manner and with the result that at no time did we really have a clear picture of the compliance of the materials with the specifications. As a result of this, our specifications or tolerances were in some cases much tighter than was economically justified and in others looser than necessary. Here, then, a simple, systematic method of record keeping over long periods of time was by itself sufficient to show the need for many revisions and point the way to the writing of more realistic specifications.

One very good application that we have for statistical analysis is in the evaluation of dielectric materials, specifically, the life time of the dielectric as a function of voltage stress and temperature. This has been a very difficult task due to the large number of variables in the make-up of the dielectrics, the extreme variation in life time within a sample group, and the great length of time required to perform a test. By examining large amounts of data, we are beginning to observe normality in distributions that used to be considered quite variable and in no way predictable. The life time of capacitors under accelerating conditions of high voltage and temperature shows a rather normal distribution when plotted on logarithmic paper; in other words, the log of life time in hours or days seems to follow a normal distribution for a particular combination of voltage and temperature. This, then, has enabled us to separate the effects of voltage stress and temperature and to observe the effect of each of these variables. As we gain more experience on this subject we hope to be able to obtain valid information from greatly accelerated tests and, therefore, evaluate materials more rapidly than at present.

Another application where a statistical approach has given us some insight as to the working of a failure mechanism has been the study of the moisture seal of a certain type of capacitor. One very simple and common way of evaluating the seal of capacitors is to subject them to any one of a number of moisture treatments and then measure the insulation resistance. Unfortunately, the distribution of this parameter is usually quite large, a ten to one variation being quite common even among perfectly good units, so that the analysis of the results from a seal test seemed at first rather difficult. By plotting the logarithm of the insulation resistance on normal probability paper both before and after the exposure to the moisture treatment, we observed a very significant picture in that in addition to a significant lowering of the insulation resistance level, there was also a distinct break or knee in the line indicating the introduction of a new distribution at a much lower level. The position of this break would vary at percentage values of five percent to 30 percent. The interpretation of this, of course, was rather simple after the observation was made; it was evident in the first place that all units dropped in resistance as a result of the moisture treatment due to the permeability of the sealing compound, but in addition a varying percentage of seals failed because of defects, giving rise to the lower distribution. Our problem then resolved itself to a study of the outright seal failures and means to reduce them. Some progress has been made and we expect to have the situation under control in a short time.

Analysis of regression and correlation is also a very strong tool which can be used when other techniques do not readily give a solution. When the number of variables is large and they are such that they cannot be controlled, it is often possible to separate the effect of each of these variables by determining the influence, if any, each has on the end result. Many times the answer is negative and no further thought need be given to their control. One case that will illustrate this point arose recently in one of our production lines where a protective coating was applied automatically to a capacitor by repeated dips, each followed by air drying and with a final high temperature cure. The nature of this coating was such that we often obtained excessive coverage on the leads of the capacitor which necessitated removal by scraping. This problem had been chronic with us for almost a year and any number of explanations had been advanced as to its cause, such as the temperature of the bath, its viscosity, the ambient temperature and humidity and probably others. Before any money was spent, however, to control these variables, we decided to collect data over some period of time during which temperature, humidity, and viscosity varied over their normal range. Absolutely no correlation was noted between the suspected agents and the coating, but the real culprit was discovered in the variable level of the material in the pot which was thought to be maintained constant and in the variation of a positioning device. The solution was quite simple and this operation is now under control.

The examples I have cited represent but a few of the applications we have made of statistical methods, either independently or with the assistance and cooperation of our quality control department. In every case the rewards have been great in either time or money saved and always in a feeling of greater confidence and satisfaction. Unfortunately, it has not been easy at times to gain the required background knowledge for the use of these techniques in experimental work, since books and literature available on this subject do not generally make for easy reading. I sincerely hope that more and more colleges will introduce at least a one semester course in this subject in addition to the immediate application of these techniques to the analysis of experimental data obtained in laboratories or other courses. The members of this society can and should continue with their pioneering work by writing articles in various engineering publications and occasionally taking a little time out to educate us engineers in the wonders of their profession.

Textile Quality Analysis

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Development of Textile Technology

The textile industry has a very interesting history. It is one of the oldest factory industries and, of course, the history of textiles in the home extends back to the dawn of civilization. We identify the first textile factories with the beginning of the industrial revolution in the eighteenth century and associate them with the invention of the ring spinning frame, the power loom, and the cotton gin. In contrast, many industries have developed from more recent scientific discoveries and advanced technical knowledge. These modern industries have grown up with scientific research and laboratory testing as an integral part of their organization.

The textile industry, on the other hand, is a remarkable example of *technological* development. Textile technology has developed from the experiences of generations of capable, energetic men whose ingenuity and resourcefulness have been sharpened by competition and the ever critical demands of the consumer. Skills, machines, and ideas developed by the patient and persistent efforts of countless individuals and groups, are our common heritage. This accumulation of inventions and refinement of technical knowledge has steadily improved quality, increased production, and diversified textile products. The immensity of this heritage, its thoroughness and scope is particularly impressive when a search of patents is made on any phase of textiles.

There comes a time, however, when technological progress slows down or even stops because of incomplete understanding of specific facts or for the lack of certain scientific discoveries. Research and scientific investigations are organized efforts to hasten this process and promote technological development in an efficient manner. This general pattern is especially true for textiles. Textile technology was reaching a slowing-down period when a series of events sparked by the development of chemical fibers reversed the trend. Currently, textile technology

is experiencing an accelerated rate of progress.

As might be expected, the first years of statistical quality control in a textile mill have been difficult. Rule-of-thumb methods for textile control and authoritative opinion are well established. The qualities measured were those emphasized by operating management, and the test methods were those that had been handed down for generations with only slight modifications. Nevertheless, the new quality control methods proved useful, and some very important improvements have resulted. Quality control charts have been effective in revealing the lack of standardization of quality (1) between machines, (2) between operators, (3) from job to job, (4) from room to room, and (5) from day to day. After surviving this initiation, we have begun to take another look at textile quality. With the advantages of research investigations and some new testing instruments, we are changing some of our opinions about textile quality.

In this respect, industrial research and quality control have a common foundation. This foundation is quality analysis. Quality analysis is an effort to know what constitutes quality in the product, and to understand the relative importance of the many factors that affect or cause quality differences. Without this information, the labor of both research and quality control may be misdirected. In certain cases, a new testing instrument or testing method must be developed in order to make a complete analysis. This is often the first step that leads to a chain of reactions and further improvements in quality. In other cases, industrial processes, like magicians, are quite successful in deceiving us about what actually is happening. Our attention is sometimes too firmly focused on the more obvious variables, and we fail to see the effects caused by others.

A Better Evaluation of Raw Stock Quality

For hundreds of years, cotton, wool, silk, flax, and other natural fibers have been bought and sold on experts' judgment of spining value. Their appraisal of quality is based upon certain distinguishable characteristics. Grade and staple classification is the basis of cotton marketing, although knowledge of production area, weather conditions, and other general factors are given particular consideration in buying mill supplies.

During the last twenty-five years, our knowledge of textile fibers has increased immensely. Development of chemical fibers with distinct physical and chemical characteristics has accelerated the study of natural fibers also. Laboratory tests have been devised for measuring fiber characteristics, and their relationship to spinning quality has been established. Industry has not been able to take advantage of all this information and assimilate it into textile technology. Natural fiber qualities are affected by qualities beyond our control, and tests for fiber strength, elongation, length and length uniformity, maturity, and degradation are too slow for commercial grading.

Measurement of fiber fineness is an exception. A method developed for measuring fiber fineness by the resistance that a standard mass of lint offers to the flow of compressed air has resulted in a minor revolution in cotton textiles. It is simple and quick enough for commercial application. As a result, the textile industry has put it to good use in helping with many of their processing troubles. Increased use of other laboratory tests can be expected to follow the excellent example set by fiber fineness.

An Example of Misplaced Quality Evaluation

Quality analysis are also being applied to manufacturing processes within the mills. Experimental investigations employing improved testing equipment and statistical analysis are examining some of the intangible relationships between processing and textile quality. Conclusions from these analyses don't always agree with established opinions. The industry moves cautiously. New evidence must be completely digested and assimilated in its massive bulk. A clear understanding of the relationships is important. That is the function of quality analysis. Total variation in quality is examined in terms of the sources that produced it. Each source is evaluated according to how much it contributes to total variation. Systematic and cause variation must also be clearly distinguished from random or chance variation.

An example of quality analysis of a textile process can be illustrated by a study of picker lap quality. Picker laps are the first of a series of intermediate products between the raw stock and the finished product (Fig. 1.) A typical cotton lap may have these specifications: 45 inches wide, 50 yards long, 14.5 ounces per linear yard, and a total lap weight of 50 pounds. Quality control at the mill has been directed toward controlling those qualities that are most easily measured, namely total lap weight, and yard-to-yard variation. Charts comparing lap yard-to-yard variation in two laps are shown in Fig. 2.

These two charts show irregularity in weight per linear yard in lap stock from picker machines in two different mills. According to mill standards, the machine in Mill B is producing a very poor lap, while the one in Mill A is processing satisfactorily. Yard-to-yard variation, however, is not the only final criteria of lap quality. An inquiring mind is not completely satisfied and insists upon the analysis of quality in terms of its effects upon subsequent quality.

Lap stock is fed to carding machines which in turn produce a rope-

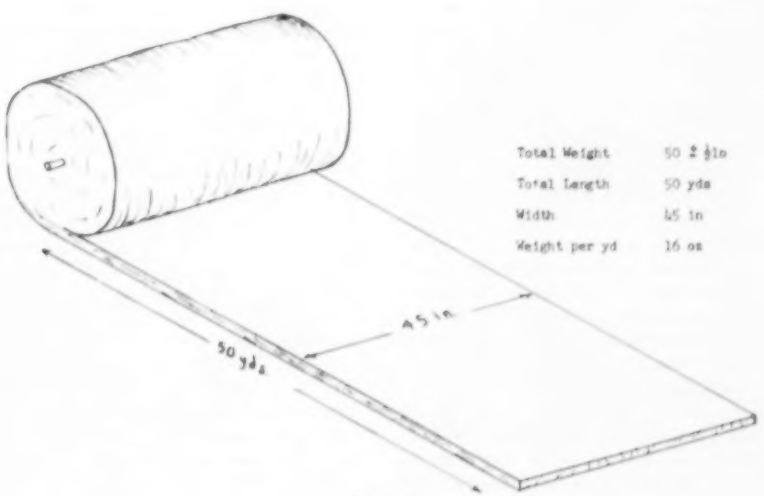


Figure 1

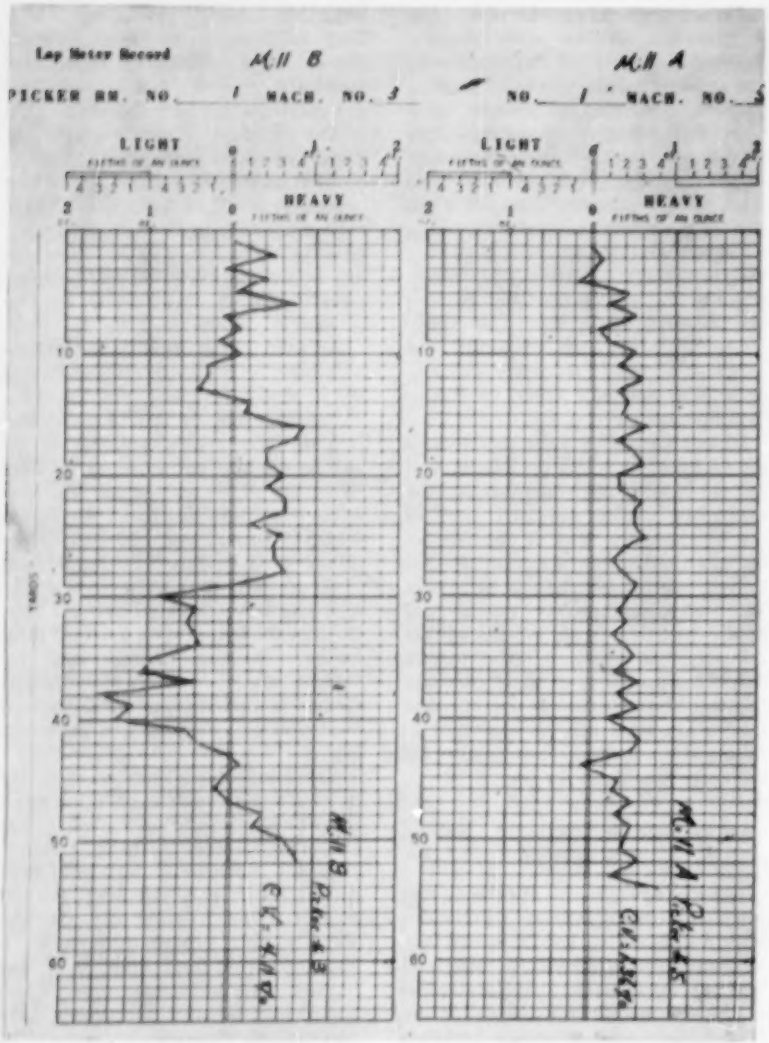


Figure 2

like strand called sliver. Card sliver weight per yard is about 60 grains, resulting from a carding draft of 100 or more. One-third inch of lap stock is equivalent in weight to about one yard of card sliver. Short length variation in the picker lap can, therefore, result in card sliver weight variation also. A lap tester was developed to measure short length variation in picker laps. Figure 3 shows sections of charts from another set of laps from the same two pickers compared in Fig. 2. Lap quality compared on this testing machine ranks the two pickers in reverse order. The picker that produced laps very poor in yard-to-yard uniformity was considerably better in short length uniformity. Figure 4 takes quality analysis one step further.

Laps from these two pickers were carded on the same carding machine and all of the sliver from each lap tested for sliver weight per yard uniformity. Every tenth yard was weighed and recorded in consecutive order. The graphs on the left represent an analysis of picker lap irregularity, reconstructed from the card sliver weight per yard data. The heavy center line is the average sliver weight per yard obtained from each consecutive yard of picker lap. The upper line represents the heaviest individual yard of card sliver from each consecutive yard of picker lap. The lower line represents the lightest individual yard of card sliver from each consecutive yard of picker lap. The average variation of sliver weight within each yard of picker lap is 8¾ grains per yard from Mill A and about 6½ grains per yard for Mill B. The frequency distributions on the right show total variation in card sliver weight per yard. The coefficients of variation were 5.52 percent and 5.75 percent respectively.

The average variation of sliver weight was determined from the following calculation. For lap 1 from Mill A

Ave. C.V. Yard - Yard (S.-L. Lap Meter) = 1.36%
Total C.V. Weight Per Yard Card Sliver = 5.52%
$V_T = V\omega + Vb$
$(5.52)^2 = V\omega + (1.36)^2$
$V\omega = 30.47 - 1.84 = 28.63$
$\sigma\omega = 5.42\% \times 52.5$ grains
$= 2.84$ grains
$\overline{R} = d_2\sigma\omega = 3.078 \times 2.84$
$= 8.75$ grains

and for lap 2 from Mill B

Ave. C.V. Yard - Yard (S.-L. Lap) = 4.11%
Total C.V. Weight Per Yard Card Sliver = 5.75%
$V_T = V\omega + Vb$
$(5.75)^2 = V\omega + (4.11)^2$
$V\omega = 33.0 - 16.9 = 16.1$
$\sigma\omega = 4.0\% \times 52.0$ grains
$= 2.08$ grains
$\overline{R} = d_2\sigma\omega = 3.078 \times 2.08$
$= 6.4$ grains

From this analysis we must draw the conclusion that lap short length irregularity is caused by a different set of factors and is produced independently of lap yard-to-yard variation. Both sets of factors are important to card sliver uniformity and should be controlled. This fact is not generally understood.

Quality Survey and Analysis at Production Level

Not content with this laboratory study alone, which showed differences in card sliver uniformity, we wanted to know what was actually happening in our plants. First, we recorded the weight of every lap doffed from a battery of pickers during a day. Second, we tested laps from each picker for yard-to-yard uniformity. Third, we measured short length fluctuation in the lap stock. These tests gave us information about our lap quality. Fourth, we determined the total amount of variation in card sliver weight per yard by taking specimens from all the cards every day for a number of days. By analyzing these data, we learned not only how much variation in sliver weight per yard existed in

each mill, but also what produced it and the relative importance of each cause factor.

Figure 5 presents data from two mills that contrast in certain details. The same data can be presented in the form of an algebraic equation, but the graphic presentation seems to be more effective. Square #1 represents lap weight variation. Square #2 represents lap yard-to-yard weight variation. Square #3 is the total variation in yard-to-yard lap weight resulting from differences in lap weights among total lap production. Square #4 represents only the short length variation that occurs within each yard of lap stock. Square #5 is the resulting short length variation found in total laps produced. Square #7 represents the total variation in card sliver weight per yard. Squares #1, #2, #4, and #7 were constructed to scale and represent actual mill stock variation determined from extensive measurements under normal operating conditions. Squares #3, #5, and #6 represent the resulting variation from two other sources, and their size was determined by calculation. Total variation in card sliver weight per yard (Square #7) was not completely accounted for by the actual measured variation in picker lap stock (Square #5). Square #6 was, therefore, necessary to represent all other sources of variation that contribute to card sliver weight variation. These might include (1) variation in moisture, (2) slight differences between cards and card settings, and (3) operating variables.

Analysis of picker lap quality was presented in detail to illustrate what can and is being done at each manufacturing process. The total variation in stock size delivered by a process must be accounted for. The total variation delivered can be explained by (1) short term variation within each machine, (2) differences among machines, and (3) long term variation caused by changes in moisture content, channeling, and other causes preceding the process. By the proper experimental procedure and statistical analysis, the contribution of each of these sources of variation can be examined and appraised.

Quality Control—Application of Quality Analysis

Short term irregularity in yarns and the preceding intermediate products have always been a serious textile problem and an important quality characteristic. An instrument for measuring short term uniformity of sliver and roving has been available since 1925. Instruments especially designed for measuring the evenness of yarn have been developed only recently. Before evenness testers were developed, boss carders and spinners depended upon visual inspection for judging this quality, and set and regulated their machines accordingly. Machine manufacturers had poor guidance in improving textile machinery, and the incentive was uncertain. Lacking a precise means for measuring yarn, roving, sliver, and lap unevenness, a great deal of tolerance was allowed and technological progress was slow. Now that we have instruments for measuring this quality, the factors that cause unevenness are receiving a great deal of attention.

Quality analysis of uneveness is needed to guide these various efforts. We have some incomplete answers to a number of questions. Part of the short length unevenness in the product from one process becomes a longer length unevenness in the subsequent process because of

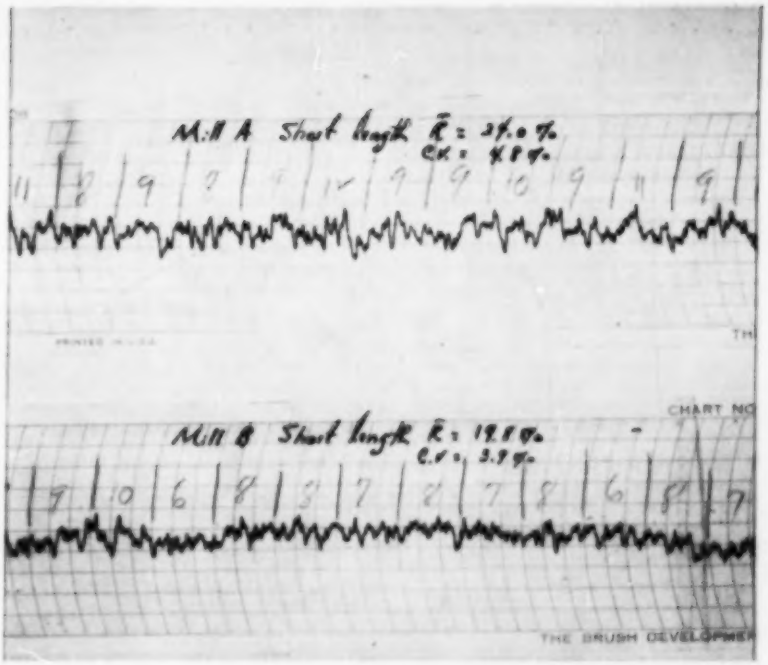


Figure 3

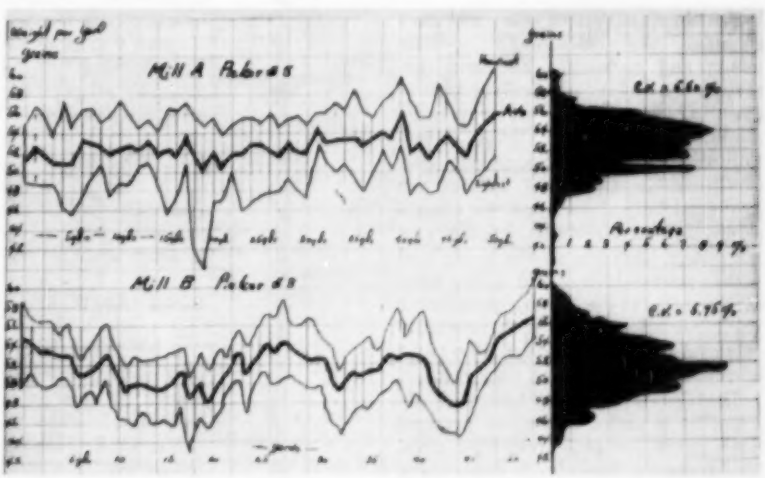
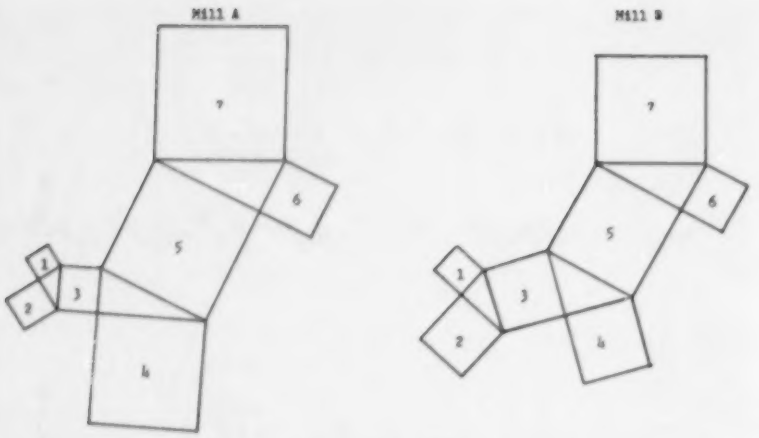


Figure 4



(7) Card Sliver $(C.V.)^2$ = (1) Lap Weight $(C.V.)^2$ + (2) Lap Yard to Yard $(C.V.)^2$
+ (4) Lap Short Length $(C.V.)^2$ + (6) Carding Faults $(C.V.)^2$

Figure 5

drafting. Consequently, we have unevenness in yarn representing the sum total of the unevenness in all previous processes. Without a great deal of imagination, one can conceive that there might be a multitude of patterns. Some of these patterns are easily detected and their effects well known. For instance, a short term cyclic pattern in drawing sliver may become a glaring defect fillingwise in the fabric. Other unevenness patterns and their effect upon yarn and fabric quality are not so obvious. How do these various patterns affect processing performance, yarn strength, fabric appearance, fabric strength, air and water permeability, resistance to tear and abrasion?

Consideration of Consumer Demands for Improvements

Textile quality analysis must also consider the consumer's specific needs and demands. The end use may require a particular textile fiber or an appropriate blend of fibers. The fabric style and construction determine its appearance and qualities. In industrial fabrics we are especially interested in tensile strength, tear strength, resistance to abrasions, bursting strength, air and water permeability, and other special qualities. Many processing variables affect each of these qualities and in different ways. The right combinations are most important.

Textiles have been and will always be a major consumer product with extensive and diversified uses. Technological knowledge concerning what fiber best suits each end use, and how to process, spin, twist and weave it into a wide range of fabrics to obtain these diversified qualities, is indeed a great heritage. Current demands for textle quality, however, are more exacting and diversified than at any time in history. There are many new fibers to help meet these demands. Competition between producers is sharp, and the consumers are critical. Authoritative opinions of experts and rule-of-thumb methods are inadequate for these demands. Operating on a balanced average is not enough. Intangible qualities of the raw stock are useful, but they are most valuable when understood and used properly. Yarn and fabric quality is affected by every process of manufacturing. Precise measurement of processing variables and analysis of quality is necessary for alert management. All signs indicate that quality control by laboratory testing will play a much greater part in textiles of the future.

Local Section News

"... BUT NOT FORGOTTEN"

ALBUQUERQUE An educational session on mixed attributes variables sampling was presented by G. J. Lombardi, Sandia Corp. at the Oct. 11 meeting. In addition, a one act play, "Sampling Inspection," by Bonnie Small of the Allentown-Bethlehem section, was presented by members of the local section. The meeting was an outstanding success and well enjoyed by all present thanks to a fine presentation and to Miss Small's ability to combine realism with humor.

BALTIMORE The 1955-56 season started with a plant tour of the Western Electric Co., Point Breeze, plant inspection and quality control operations. Approximately 70 members and guests were in attendance.

BINGHAMTON A joint meeting with the newly formed Corning-Elmira section was held Oct. 11 in Elmira, N. Y. The Binghamton section was especially pleased to see the amount of interest shown by this new section, as the Binghamton section was instrumental in the formation of the group.

Mr. C. E. Fisher, executive secretary of the society, presented "The quality assurance at the Bell Telephone lab." A dinner preceded Mr. Fisher's excellent talk.

BIRMINGHAM The first annual all-day forum of the section was held on Oct. 13. It was jointly sponsored by the University of Alabama and the Birmingham and Huntsville sections. The program included the following: Dr. J. M. Juran—"Managing a quality control program;" Dr. Robert Lusser—"Reliability of guided missiles;" Dr. Paul Hummel—"What is quality control;" Leonard M. Freeman—"Application of quality control in the tire industry;" Prof. Robert LaForge—"How to sell quality control to management;" James C. Sorenson—"The Air Force quality control plan-procurement."

Approximately 50 members and guests of the section attended the Sunday afternoon fall picnic at Lane Park, Birmingham, on Oct. 23. Beautiful weather prevailed with temperatures in the middle eighties. A good time was had by all, attending the zoo, pitching horseshoes, playing softball and touch football, following which a supper of hot dogs, beans, potato chips, hot chocoate, soft drinks, ice cream and roasted marshmallows was served. The above photo shows some of the "quality controlled" children attending.

BUFFALO H. N. Dudley, Sylvania Electrical Products, Emporium, Pa., presented an interesting talk, "Conference training in quality control" at our last meeting. His talk covered the subject very well. Preceding the session a dinner for members and guests was well attended.

BURLINGTON The second annual educational seminar of the section was held Oct. 19 at the Hotel Bardwell, Rutland. R. W. Hooley of the commerce and economics department, U.V.M., conducted a clinic in "Control chart ideas for reducing manufacturing costs." C. F. Murphy, National Carbon Co., held a session on "Ranking methods to improve quality judgments." The clinic of C. Gadzinski, General Electric Co., had for its subject "The analysis of significant differences" and "Acceptance sampling procedures." Robert Jones, manager of manufacturing, Jones & Lamson Machine Co., Springfield, conducted a management seminar in "Modern control ideas."

After a cocktail hour and dinner, the members and guests were addressed by Dr. Wayne S. Broehl who spoke on the subject of "Raiding and merger in American business." Dr. Broehl's talk was a welcome respite after an afternoon of statistical analysis as he entertainingly and searchingly discussed these facets of the economic picture. Dr. Broehl is a member of the faculty of the Amos Tuck school of business administration, Dartmouth College, specializing on top management organization and control.

BUZZARDS BAY Roy G. Volkman, chief chemist of mechaical goods at the United States Rubber Co. in Providence, was the main speaker at the Oct. 11 meeting. Mr. Volkman's address was entitled "The acceptance control chart."

CHICAGO At the second dinner meeting of the section on Oct. 19 the members and guests heard addresses given by men well known in their fields in this area. Richard B. Wittman, manager of quality control administration at the Ford Aircraft Engine plant, spoke on "Management of quality control." Dr. Paul H. Randolph of the Illinois Institute of Technology addressed the group on "Multivariate analysis in sampling inspection." Their topics were very enjoyable and informative. The evening speaker, Dorian Shainin of Rath & Strong Associates and a vice president of the society, addressed the members and guests on statistical techniques. Mr. Shainin, the designer of the now famous "lot plot" and greatly responsible for the pre-control technique, gave his audience a wealth of information about techniques and how to use them.

The initial meeting of the Calumet sub-group of the Chicago section was a dinner meeting held in Gary, Ind. on September 20. The guest speaker was Prof. Irving W. Burr. The above photo shows Prof. Burr addressing the seventy members and guests present during his talk which was entitled "How to be practical: statistical quality control." Seated to the left of the professor is Dr. Marjorie Sutherland; Prof. Nicholas Relich of Purdue University is seated to the right.

CINCINNATI F. C. Schulze, sales engineer of Hunter Spring Co., Lansdale, Pa., spoke at the Oct. 19 meeting. His theme: "Customer-vendor relations."

The section is proud to announce the formation of the Hamilton subsection whose membership is representative of many local industries. Among officers elected was the chairman, Charles K. Sherck of Pillsbury Mills, Inc. The subsection was organized to better serve interests of members in the Hamilton area which is about 25 miles from Cincinnati.

CLEVELAND The second Cleveland conference was highly successful and very well attended. Heading the conference committee was Howard Schmidt of the Aluminum Co. of America who produced an excellent program with 13 nationally famous speakers. The luncheon speaker was Louis

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Seltzer, editor of the Cleveland Press, who gave an excellent talk on the need for quality control of people to deal with the complex problems ahead in the world of tomorrow. Carlisle K. Milner, vice president of the Ohio Bell Telephone Co., spoke on personnel problems. Cleveland will long remember the excellence of the technical speakers and the fine program that was presented.

The first course in fundamentals of quality control is being presented by the section on Monday evenings at the Carter Hotel, Cleveland. The instructor is Chas. Kendel, chief inspector at Lamson & Sessions Co. Mr. Kendel was last year's section chairman.

COLUMBUS Arthur F. Schroeder, general manager, Ohio Axle & Gear Div., Rockwell Spring & Axle Co., spoke informally on Oct. 19 to the members of the section following a tour of the plant which is located at Neward, Ohio. The plant is engaged in the manufacture of truck axles, starting with housing blanking and finishing with complete assembly.

The section is conducting a five session basic course in quality control procedures. Following this course, several round table discussions on the establishing and administering of a quality control department will be held. The climax of the training program will be reached when certificates of completion are presented to all successful candidates at the annual management dinner to be held Feb. 16.

CORNING -ELMIRA W. A. MacCrehan of Bendix Radio Div., Bendix Aviation Corp. in Baltimore, delivered a lecture on "Consumer-vendor relations—a challenge to reliability" before a joint meeting of the Binghamton and Corning-Elmira sections on Oct. 11 Mr. MacCrehan spoke before approximately 150 people at the dinner meeting and discussed the procedures used in setting up the consumer-vendor program at Bendix.

Dr. Robert Bechofer of Cornell University delivered the first in a series of 12 lectures on SQC at the Westinghouse Horseheads plant on Oct. 16. The lecture series is divided into three groups of four lectures each—"An introduction to statistics," Dr. Bechofer; "An introduction to statistical quality control," Jack Cherry of Westinghouse; "An introduction to attributive sampling," E. B. Godsey of Corning Glass Works. Enrollment at the first meeting, which involved a discussion of statistical distributions and definitions, consisted of 46 persons from the Bath and Corning-Elmira areas.

DALLAS -FORT WORTH On Oct. 13 Dr. Lewis Fowler, Monsanto Chemical Co., St. Louis, Mo., presented a talk on "Validity of measurements," which contributed much to one of the section's most successful recent programs.

DAYTON The regularly scheduled meeting for October consisted of a plant tour and dinner at Aeroproducts, Allison Div., GMC at Vandalia, Ohio. An interesting talk was presented by Wm. Collelo of Aeroproducts on their use of quality control and a brief description of the tour and the things to be noted as to the use of quality control in the manufacture of their products. The interest in this meeting was indicated by the fifty some members that attended.

DELAWARE The first meeting of the 1955-56 season was an outstanding success celebrating as it did the decennial of ASQC and the section. A capacity turn-out of 60 persons including members and their wives heard W. A. MacCrehan of Bendix Radio Div., Bendix Aviation Corp. discuss "The quality control engineer in action." In his presentation, for the benefit of the ladies, Bill utilized the baking of a cake as his example in studying the causes and effects of variation. Demonstration gadgets were used to illustrate many of his points. The speaker emphasized that "Quality control in action" covered the following fields: administration channels, raw materials, IBM recording of data, vendor quality rating, technical procedures, quality education and process controls.

A salute was given to the past chairmen of the Delaware section at this meeting. Those present were: Charlie Bicking, 1945-46; Frank Grubbs, 1948-49; Vern Lewis, 1949-50; Pat Bruno, 1950-51; Henry Clark, 1951-52; Jim Garrett, 1952-53; and Bob Fleck, 1954-55. Each of these past chairmen were introduced and gave a few comments on the progress made during the first ten years of the section.

DENVER Warren Alberts, director of industrial engineering and operations research at United Air Lines provided a stimulating discussion of his paper entitled "Quality control, industrial engineering, and operations research" to a highly interested group which consisted of twice as many guests as members. Guests and members came from as much as 60 miles away for this first scheduled meeting of this year's program.

Since Colorado is practically synonomous with vacationland during the summer, the year's activity begins with our October meeting. Judging by the first meeting we are off to a fine start.

ERIE Bill Lesser, quality control supervisor of General Electric's specialty control dept. at Waynesboro, Va. presented "The cost of quality" to our management night group on Oct. 5 at the Elks Club. The program was well received by the executive guests.

The officers held a special business luncheon on Oct. 26 and discussed plans to shore up the sagging membership. It was also decided to rotate meeting places to silence the grumblers whose ulcer demands variety in its diet.

GEORGIA John H. Reynolds, statistician, Celanese Corp. of America, Rome Ga., presented "Decision making" to the Atlanta group at its regular meeting on Oct. 25. The case illustrations were excellent. Mr. Reynolds always gives an instructive talk of real value.

GREATER MUSKEGON John Welch, supervisor of quality control at the Keller Tool Div., Gardner Denver Corp., Grand Haven, Mich. outlined their method of QC. Emphasis is placed on machine capability charts which eliminates many unnecessary production charts. Their system has been very successful.

The Oct. 13 meeting was the first of the current season and was attended by 42 members and guests, an all-time attendance record for the section. The efforts of the membership committee under Roland Beyer's chairmanship was very evident.

HARRISBURG The October meeting was addressed by John Hood, assistant chief metallurgist, quality standards, Aluminum Co. of America. His topic for the evening was "Some practical uses of statistical quality control in the aluminum industry,"

during which he related the objectives and the means by which they are reduced to actual practice at Alcoa.

A total of 60 people have registered for the basic and advanced courses offered by the section.

HARTFORD The monthly meeting of the executive board was held at Club Alden on Oct. 5. Chet Govang, president, was voted to be local director for the New England district. After new appointments were announced and accepted the board discussed the idea of having this year's Hartford section business meetings include one or more panel discussions on pertinent quality control subjects. It was decided that recommendation be made to the proper officers to look into the matter.

The first monthly dinner meeting was held at the Rockledge Country Club on Oct. 13. The large audience was well pleased with the speaker who was Ralph E. Wareham of Columbia University's industrial engineering staff. Mr. Wareham was the second president of the society and he outlined some of his interesting experiences encountered while serving as consultant to industry on QC management.

Members present were previewed as to the forthcoming year's activities including the educational program being offered.

INDIANAPOLIS Ervin F. Taylor of the North American Aviation Co. of Columbus, Ohio spoke on "Discovery sampling" at the Oct. 18 meeting. Interest in sampling is at a high level and the discussion was lively. The pre-meeting training session was conducted by Don Flanders of Allison Division, GMC.

The evening school classes at Arsenel Technical High School are off to a good start. Sixty-two students, some of whom come from towns as much as 50 miles away are enrolled in the variety of courses offered at this time. Mel Handerson of Western Electric has the basic and charting course. Frank Weeks of Allison Division, GMC has the sampling course. Bob McNeff of Diamond Chain has the intermediate techniques course and Francis Bucksot of International Harvester Co. has the advanced course on administration. These instructors are all qualified QC men with considerable teaching experience.

KANSAS CITY The October dinner meeting was well attended by members and friends. Parke Carroll, vice president and business manager of the Kansas City Athletics, Inc., presented a very interesting review of the problems that beset a major league baseball team. Baseball managers demonstrate that statistics and operational observations can be used to improve quality in their product as similar analyses are used in industry.

LINCOLN The section met at the Capitol Hotel on Oct. 14. Dr. Frank Dudek, department of psychology, University of Nebraska gave an excellent presentation on analysis of variance with particular reference to factorial and Latin square designs.

The membership meeting held Sept. 16 has brought in seven applications for membership which brings the number of paid up members to 43.

METROPOLITAN The seventh annual Rutgers all day conference sparked the opening of the fall season for the quality control minded metropolitan members. Especially noted were the many new advocates of statistics in quality control—well over half in attendance were newcomers. Talks ranged from advanced statistical optimizations to applications in graphic arts and ceramics. A well received management panel stimulated lively discussions. A highlight of the day's program was the luncheon address presented by Dr. Paul Clifford. Dr. Clifford related the experiences of his recent European tour. He reported that the Europeans generally are well-versed in quality control theory, but that they don't seem to have facility to effectively apply these theories to their production problems.

"Recent developments in statistical techniques and quality control" was the theme of the most recent section meeting held Oct. 20. Dr. Acheson Duncan, Johns Hopkins University, discussed sample size, sampling intervals, and significance limits for the X chart under given cost factors in his "Economic design of the X chart" presentation. Dr. Robert Bechofer, Cornell University, presented a new mathematical approach to management decision making in his talk, "Multiple decision procedures for ranking means." Fundamentals of quality control were persented during the pre-meeting clinic by N. C. Pavacich, Western Electric Co.

MICHIGAN The initial program of the Wolverine subsection was held on Oct. 7 at the Upjohn Auditorium in Kalamazoo. Lloyd O. Neujahr discussed "Practical uses of quality control applied to the pharmaceutical industry."

Another subsection meeting was held at the Dow Auditorium in Midland on Oct. 19. Deland H. Davis gave a very interesting talk about "Quality control in a cereal food industry."

The Michigan section itself opened its 1955-56 series of meetings with a session at Wayne University in Detroit. Guest speaker for the evening was Dr. Phillip Whidden of Alcoa.

MILWAUKEE Seventy five members and guests of the section heard Dr. Dan B. DeLury, director, department of mathematical statistics, Ontario Research Foundation, Toronto, Canada, speak on the "Design for making good measurements." Dr. DeLury provided an easily understood treatment of a fundamental subject.

MINNESOTA The section held its annual quality control clinic at the Nicollet Hotel in Minneapolis on Oct. 6. Over 200 registered for the clinic and attended its many meetings which covered various phases of the problems dealing with QC in the fields of electronics, office applications, vendor relations, the process industrials, and a general interest group. All sessions were well attended and the interest in the problems discussed indicated a growing concern for the need of better quality control to cut production costs. Howard Mold of Minneapolis-Honeywell Regulator Co. was the dinner speaker and spoke on "The business of management."

MONTREAL The regular monthly meeting was held Oct. 19 in our new location at the Mechanics Institute. The accommodations were considered to be excellent. R. Vance Ward delivered a very fine talk on "Applications of SQC in the chemical industry." All members and guests found value in the words of Mr. Ward and recognized applications for their own use.

MUNCIE A. A. Hamm, engineering dept., Delco-Remy Div., General Motors Corp., spoke before the members of the section on the topic "The stack-up of tolerances from a probability viewpoint."

NEW HAVEN On Oct. 11 the second meeting of the season featured Richard A. Cotter of the Speidel Corp., Providence, R. I. as guest speaker. Mr. Cotter, manager of the industrial division of Speidel, presented a well received lecture on the topic "Introducing quality control to shop personnel." Earl Lamm, originally scheduled to speak, had to cancel due to business obligations.

The section recently conducted a series of lectures on the basic fundamentals of quality control in cooperation with the industrial management club of New Haven for their membership. Five weekly sessions were held on the following topics of QC: "Why it works; how it works; acceptance sampling; work sampling; jobs for quality control." Forty members enrolled for the series, with members of the section's executive committee serving as lecturers and instructors.

PHILADELPHIA The October meeting was a real success. Roger Crane held the podium with his interesting talk on operations research. Mr. Crane is with the Westinghouse Air Brake Co. where he serves as director of operations research.

PITTSFIELD J. D. Heide, United States Rubber Co., addressed the section at its regular dinner meeting Oct. 6 at the Stanley Club, Pittsfield. A group of 35 members and friends heard Mr. Heide's excellent discussion of "Testing for significance." A copy of the speaker's textbook, *Industrial Process Control by Statistical Methods*, was given as a door prize.

On Oct. 28, the section held an all day educational clinic at the Stanley Club on the subject "Management and the costs of quality." Messrs. W. J. Masser and F. J. Berkenkamp, of General Electric's manufacturing division, were the very effective moderators of the clinic, which attracted over 20 members.

RHODE ISLAND Axel Sternloff of the American Steel & Wire Co., Worcester, Mass. spoke on deviations at the October meeting. His talk was well accepted. A pre-meeting "off-the-cuff" discussion was held by "Cliff" Kennedy of Federal Products. His pre-meeting discussions occupy the early comers until the regular meetings start.

ROCHESTER Henry B. Elkind, supervisor, central testing laboratory, American Sugar Refining Co., spoke on the subject "Quality control applications in the food industry" at the Oct. 18 meeting.

ST. LOUIS The section had an exceptionally fine turn out for H. J. Jacobson's talk on quality control by infiltration, presented at the Oct. 21 meeting.

SAN BERNARDINO A record turnout of members and guests heard Dr. Edward P. Coleman at the last section meeting held in Pomona. Dr. Coleman, instructor in the engineering college at UCLA discussed the subject "Some fundamental concepts in industrial quality control." Dr. Coleman pointed out the basic differences in the points

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of view of production people, of inspectors, and of management, and showed how the function of quality control could help integrate these viewpoints into a team effort. A feature of the program was the visit of two classes in SQC taught by section members Bill Goddard and Ray Mute.

SAN FRANCISCO BAY AREA At the October dinner meeting members and guests were addressed by Dr. Stephen Allen, operations analyst with Stanford Research Institute. Dr. Allen's talk entitled "Mathematical problems in inventory control" described the operations research approach to several specific inventory control studies in industry.

Section chairman Gerald Lieberman was justly pleased as he reported on the success of the second annual San Francisco Bay Area quality control conference held last Sept. 16 with a total registered attendance of 175.

SCRANTON -WILKES-BARRE One of the largest groups to date attended the October meeting. The reason for such a large turn out was the Johns Mansville film on modern quality control. The film, one of the best on quality control, was excellent. The commentator was P. B. Proctor, assistant director of quality control at Johns Mansville. After the film, Mr. Proctor held a question and answer discussion, which was interesting to all.

A film, "The Jet Story," by General Electric, was also presented and enjoyed by the group.

Our pre-meeting clinic proved to be a success with more than 20 members and guests attending. It was conducted by Gerald Kriss, educational chairman, and Carl Larson, vice chairman, who explained and demonstrated the basic terms and principles of quality control.

SEATTLE A. J. Golick, superintendent of quality control, Seattle Door Co., presented "The quality control director in small business" at the October meeting.

SOUTH TEXAS The Oct. 12 meeting featured a tour of Schlumberger Well Surveying Corp.'s plant in Houston. The interesting plant tour was attended by one of the largest groups in the history of the section. Dinner was served in the plant cafeteria, courtesy of Schlumberger. Following the dinner, a brief address by Schlumberger's quality control supervisor, John Bowling, acquainted the group with Schlumberger's history and origin and how quality control was developed at the plant.

SOUTHERN CONNECTICUT The section has opened up the 1955-56 season with a pleasant surprise to the executive committee headed by Chairman Ed Demers. The meeting of Oct. 12, held at the Stratfield Hotel in Bridgeport, was by far the biggest in attendance for the opening meeting in the history of the section. The principal speaker for the kick-off meeting was Brent C. Jacobs, Jr., chief industrial engineer, Chrysler Div., Detroit, Mich. His topic for the evening was "Machine tool capabilities." The interest in QC was shown by a high number of non-members who attended and the executive committee had a busy evening welcoming them. Stuart Lyle, Jr., our membership chairman, was in his glory handing out applications to those people who were interested in becoming ASQC members.

STATE UNIVERSITY OF IOWA The first meeting of the 1955-56 season was held Sept. 29-30 at the Rock Island Arsenal, Rock Island, Ill. The first day of the meeting consisted of a tour of the arsenal and a panel discussion of their operations. The dinner held on the evening of the first day featured D. L. Meyers, chief of the engineering division at the arsenal, who spoke on "The possibilities of space flight."

The following morning R. W. Boeke, of Deere and Company, spoke on "Probability and the OC curve." The meeting concluded with the customary "problems clinic" wherein quality control problems in manufacturing are discussed. A drawing for door prizes was held for those members attending the entire two day conference.

The section held its 12th annual ten day training course in quality control by statistical methods. The first day was devoted to an explanation of the aims and the possibilities of a quality control program in the plants. This special first day session for executives was for those unable to attend the full course, as well as the trainees. Attendance for the first day meeting was 121, with 98 registered for the entire period. The course was under the direction of a university administrative committee composed of Dean F. M. Dawson, college of engineering, and professors Allen T. Craig, Robert V. Hogg, Jr., and Lloyd A. Knowler, department of mathematics and astronomy, college of liberal arts.

TOLEDO The second meeting of the section further propagated the series of educational meetings with a trip to the Whirlpool Corp. at Clyde, Ohio. The plant tour was preceded by a dinner at the plant, and the tour itself illustrated quality control in action.

TORONTO The above photo shows some of the section listening to an explanation of screw making during the section's recent visit to the P. L. Robertsons Mfg. Co., Milton.

On Oct. 19, approximately 30 members enjoyed a very interesting plant tour through Anaconda American Brass Co., New Toronto, our host being Ed Beggs, a member of our section.

UTICA At the October meeting of the section, I. C. Kepner, IBM Corp., Endicott. N. Y. presented a well received talk before a sizeable and interested group. The entire section membership was present along with guests from the local area industries. An executive committee meeting was also held and future plans for the year were formulated.

WESTERN MASSACHUSETTS On Oct. 5, the section in conjunction with the Massachusetts dept. of education started a 15 week intermediate industrial statistics course. There were 52 in attendance for the first class wherein the text to be used is Dixon & Massey's *Introduction to Statistical Analysis*. The instructors, members of this section, are J. Hinchen, M. Blew, and C. Baumann.

On Oct. 18 Frank W. Catudal, loss control engineer for the Traveler's Insurance Co. of Hartford, spoke to 33 members and guests of this section as to the activities of the engineering loss control section of a liability insurance company. Mr. Catudal reviewed the various risks involved in industrial activity such as pressure dangers, equipment failure, dust hazards, product liability, etc. Methods of measuring these risks and areas of possible failure were described in detail and further illustrated by slides.

WICHITA The section held its monthly dinner meeting Oct. 8. One hundred six members and guests met at Ted's Famous Grill in Coffeyville, Kansas. R. I. Weimerskirch, general quality control manager, metal division, Continental Can Co., Inc., was the principal speaker. He delivered an illuminating and highly informative lecture to all in attendance. Mr. Weimerskirch was introduced by D. E. Hillman, section program chairman.

William Thorne, assistant general manager of Continental Can Co. plant no. 95 opened the meeting by welcoming everyone to Coffeyville. During the day, conducted tours for all present through Coffeyville's McGugin Field Continental Can plant were directed by Fred L. Jehle and his staff. Mr. Jehle is assistant quality control manager at Continental Can plant no. 95.

R. W. Watson, quality control manager at plant no. 95, made the arrangements for the October meeting with the assistance of D. E. Hillman and A. J. Kovac of Wichita. Mr. Watson is chairman of the section.

WINNEBAGO The first fall meeting of the section was held Oct. 3 at the Hotel Menasha. A training session conducted by Carl Noble was held prior to the dinner meeting. The speaker for the evening was R. Lace, technical director of the Riverside Paper Corp. Mr. Lace, a member of the section, spoke on the subject "Competitive quality—mountain or molehill." A question and answer period followed the talk.

WORCESTER August B. Mundel of the Sonotone Corp., Elmsford, N. Y. gave a very good talk on "What can quality contribute to industry" at a meeting of the section held on Oct. 20. There was considerable interest shown at a question and answer period after the talk.

YOUNGSTOWN Geo. E. Meese, senior illuminating engineer of the General Electric Co. gave a fine talk on "Management's feeling toward quality control" at the season's first meeting. A good turnout was on hand to hear Mr. Meese give his views toward quality control methods in modern industry.

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ALBUQUERQUE On Jan. 18 the section will join with the combined New Mexico technical and scientific societies in participating in a general meeting and exhibit on "Civilization through tools."

BINGHAMTON The next section meeting will be held at the Vestal American Legion, Vestal, N. Y. on Jan. 10. The speaker will be R. M. Hofstead of Bristol Labs, Inc. Syracuse, N. Y. Mr. Hofstead will speak on "Design of experiments."

BIRMINGHAM On Jan. 12 R. V. Flint, chief industrial engineer, basic standards, U. S. Steel Corp., Pittsburgh, Pa. will deliver a talk entitled "Multiple correlation of blast furnace variables." Mr. Flint has had 18 years experience in the fields of design of operating control systems and establishment, maintenance, application and general administration of operating standards. This talk will show effects of variations in operating conditions on blast furnace cost, as indicated by an analysis of approximately 10,000 blast furnace samplings and is expected to be of general interest. The section will be host to the Society for the Advancement of Management and the American Institute of Industrial Engineering at this meeting.

BURLINGTON On Jan. 18, members of the section and guests will meet at the Woodstock Inn, Woodstock, Vt. Prof. Mason E. Wescott of Rutgers University will be the dinner speaker. His presentation is another in a list of planned programs designed to acquaint industrial representatives of the south and central portions of the state with the manifold application and advantages of SQC.

CHICAGO On Jan. 17 the Calumet sub-group will hold their 3rd dinner meeting at Vogel's Restaurant in Hammond, Ind.

CINCINNATI The section has scheduled the annual conference for Jan. 28 which will be titled "Operations quality control." This will be a "workshop" type conference. Among the speakers scheduled will be Warren Purcell of Rath & Strong who is a member of the paper and fibre committee and Dave Foster of U. S. Testing Laboratories.

CLEVELAND The first meeting in 1956 will feature Prof. W. Allen Wallis, University of Chicago, at the Cleveland Engineering Society on Jan. 6. Prof. Wallis will speak on the subject "Rough and ready statistical tests." Five technical books on quality control by Blackwell & Gushick, Cochran & Cox, Romig, Morse & Kamball and Youdin will be given as door prizes to attending members.

COLUMBUS On Jan. 18 the annual dinner meeting will be held at the Trenstedt Manufacturing Div., General Motors Corp., Columbus. Following the dinner Gordon A. Olson, supervisory engineering quality control and past chairman of our section, will speak on "The use of charts to give direction to vendor quality."

CORNING -ELMIRA The first meeting of the new year will be held in Corning on Jan. 10. E. C. Polidor, vice president of Optical Gaging Products, Inc. of Rochester, N. Y. will speak on Inspection by optical projection methods."

DAYTON The first of two meetings in January will be held Jan. 12 in the form of a dinner meeting. The speaker will be Dr. J. H. Toulouse, Owens-Illinois Glass Co. who will talk on "Training in quality control." Dr. Toulouse is not a new speaker to the Dayton section. On his previous visits to Dayton his talks proved to be of great interest as indicated by the large number of members that heard him and the interest shown by the number of questions asked at the end of his talks.

DELAWARE The January meeting of the section will be held at the Lord De La Warr Hotel on Jan. 5. L. I. Horner, technical superintendent of Celanese Corp. of America will be the guest speaker, his subject being "Textile quality control."

The third session of the educational clinic of the section will precede the regular dinner meeting on Jan. 5. The subject of this session is "Control charts for ranges." These sessions are ably conducted by Hillman Harris and cover some of the fundamentals of SQC.

ERIE On Jan. 11 Herbert Mitchell of Turco Products will present a program entitled "Flaw location." A 16 mm film and a demonstration of Turco's dy-check and check-spek dye penetrant methods will be featured.

GEORGIA The program of the Atlanta group is being changed on Tuesday, Dec. 27, when "Breaking strength control limits for various yarn numbers" will be discussed by E. G. Field, consulting management engineer, Atlanta, Ga. This will be an opportunity for the textile members to get together and make plans to attend the coming textile division meeting in Virginia.

The spring program of the Atlanta group listing subjects for the regular monthly meetings from January to May inclusive will be released soon.

GREATER MUSKEGON Arthur Bender of the Delco-Remy Corp. and president of the society will address the section at a dinner meeting to be held on Jan. 12. An invitation has been extended to the Grand Rapids section to hear Mr. Bender. This meeting should prove to be the highlight of the year for the section.

HARRISBURG The Jan. 4 meeting of the section will have Carl L. Smith as guest speaker. Mr. Smith of the International Resistance Co. will have for his topic "Quality control tailored to suit."

KANSAS CITY The Jan. 11 dinner meeting will be held at the Blue Hills Restaurant. The guest speaker will be Prof. Lloyd A. Knowler of the University of Iowa. At that institution he is head of the department of mathematics and astronomy. His subject will be "Statistical quality control."

LOUISVILLE We are looking forward to our January meeting. At that time, Guy Parkin, Minnesota Mining & Mfg. Co., will discuss the highly significant topic "Tests of significance." The meeting will be held at 8 pm in the auditorium of Joseph E. Seagram & Sons.

METROPOLITAN The annual business meeting of the section will be held at the Hotel Statler, New York, on Jan. 18. This will be a dinner meeting, and a well-known guest speaker will be on the program.

MICHIGAN The Wolverine subsection has a program scheduled for Jan. 6 at the Post Cereals Club in Battle Creek. Guest speaker will be Prof. Gayle W. McElrath who will discuss "Principles of acceptance sampling."

On Jan. 21 the Michigan section will hold its annual dinner meeting and dance at the Park Shelton Hotel in Detroit. Feature of the dinner meeting will be a special talk by E. C. Yehle, entitled "The distaff side of quality control." Members of the section are asked to make plans early to attend.

MINNESOTA The section and the Minnesota Industrial Chemist Forum will hold a joint dinner meeting at the Curtis Hotel on Jan. 17. The speaker for the evening will be W. J. Youden who is a consultant with the National Bureau of Standards in Washington. His subject will be "Getting the most out of your industrial experiments."

MUNCIE R. G. Fitzgibbons, Missile section, Bendix Aviation Corp., Mishawaka, Ind. will speak before the section Jan. 19 on the topic "Automatic data processing for quality control."

NEW HAVEN The January meeting will be a joint dinner meeting with the Society for Advancement of Management (SAM). Thomas A. Budne, Philip Morris & Co. will speak on "Practical tips on sampling."

PHILADELPHIA "Quality control in the food industry" is the theme for H. Elkind's talk on Jan. 20. Mr. Elkind is supervisor of the central testing laboratory at American Sugar Refining Co.

PITTSFIELD On Jan. 5, the section will hold its annual ladies' night, a regular feature of the group's schedule. The affair this year will include a plant tour, a motion picture illustrating the uses of quality control in industry, and dinner at the Stanley Club in Pittsfield.

RHODE ISLAND The program for Jan. 19 will be a panel discussion on "Quality control problems." Cliff Kennedy will conduct the panel with Roy Volkman, R. Shaw Goldthwait, John Hird, and Neil MacLaren as panel members. This should be a lively session.

ROCHESTER Bernard A. Hutchins, Eastman Kodak Co., will present "Simple quality control techniques useful in an analytical laboratory" at the Jan. 17 meeting.

ST. LOUIS In January the section is in for an unusual treat through the courtesy of the management of the Ford Motor Co. who will play host for a complete tour of their local Mercury plant—one of the finest equipped for manufacturing assembly equipment now available in the automotive industry.

SEATTLE A joint meeting with the Washington State Purchasing Agents is planned for Jan. 12. The time and place of this meeting will be announced at a later date.

SOUTH TEXAS Of especial interest to the section will be the Jan. 11 meeting, when Charles A. Bicking will be the guest speaker. Mr. Bicking, Office Chief of Ordnance in Washington, is a member of the editorial board of *Industrial Quality Control*. He has authored and co-authored enough articles in national publications so that he needs no introduction to this section. Suffice it to say that Mr. Bicking has chosen as his subject "Establishing a quality control program" and that he will speak to what, we predict, will be an overflow audience.

SOUTHERN CONNECTICUT On Jan. 11 the monthly meeting of the section will have as its speaker George Scheel, Sonotone Corp., Elmsford, N. Y. His topic will be "Long-range data analysis" and he will present the practice of collecting and analysing long-range data with case histories pertaining to soldered joints and transitor manufacture. This will be an excellent opportunity for members as well as non-members to learn about the mighty mite that is supplanting electron tubes. The meeting will be held at the Stratfield Hotel, Bridgeport with a dinner at 6:30 pm preceding the business meeting at 8 pm.

STATE UNIVERSITY OF IOWA The January meeting will be a two day conference to be held Jan. 26-27 in Des Moines, Iowa. This meeting will feature a plant tour of the Armstrong Rubber Manufacturing Co., with a panel discussion of the tour.

Arthur Bender, Jr., president of the society, will speak to the group. His subject will be "Kwiksee." The meeting will also include a "problems clinic"—a discussion of quality control problems presented by members.

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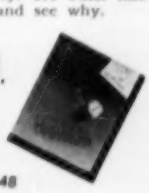

GET THE FULL FACTS — REQUEST BULLETIN 48

TORONTO Our regular monthly meeting Jan. 11 will have Dale S. Lobsinger, United Air Lines, Denver, Colo. as guest speaker. His subject will be "Quality control in clerical activities."

May I take this opportunity on behalf of the Toronto section officers and members to wish one and all a very Merry Christmas and a prosperous New Year.

WESTERN MASSACHUSETTS On Tuesday, Jan. 17 the section is to deviate from the regular pattern of having a panel discussion wherein such items as quality cost relationships, quality mindedness, and executive recording will be discussed. The meeting will be at the Sheraton-Kimball Hotel in Springfield.

The educational committee of the section is planning to conduct a one day work shop in sampling techniques about the middle of February. The emphasis will be with respect to various military standards.

WICHITA The Jan. 3 meeting will be held at the Polar Bear Club in Wichita. William Collins, representative of Frontier Chemical Co., will speak on the "Application of quality control in the chemical industry." This should prove to be a very interesting and enlightening meeting to all.

WINNEBAGO The section's January meeting will be held at the Beaumont Hotel, Green Bay, Wis. The program for this meeting will be announced at a later date.

WORCESTER Charles A. Reed of the Telechron Dept. of GE, Worcester, will be the speaker at the Jan. 19 meeting. His subject will be "A quality control technique for the establishment of finish specifications." Mr. Reed is a member of our section.

YOUNGSTOWN On Jan. 5 W. J. Masser will address the section at a dinner meeting to be held in the newly decorated Mural Room. Mr. Masser's subject is entitled "Process capability study with a slide rule."

"AS YE SOW . . ."

BIRMINGHAM Plans are being initiated to commence a course of evening classes on statistical quality control in collaboration with the University of Alabama in Birmingham beginning early in 1956.

CHICAGO Robert Storer of the Ordnance Ammunition Center and chairman of the introductory education program will conduct the fifth meeting of this series at Navy Pier on Jan. 12. This program was designed to help new comers in our field better understand quality control, to assist people already in QC work, and for those desiring a refresher course.

GEORGIA The section has a special committee on training courses that has been examining courses by other sections. Books are now being circulated among the committee and it is expected that an early announcement can be made of the committee's selection for the first course to be given by the section. This committee includes F. G. Christodoulo, Macon; Dr. A. G. Cohen, Athens; E. G. Field, Atlanta; D. S. Holmes, Atlanta; and David Reid, Savannah.

HARTFORD The clinic sessions of the Hartford Society for Measurement and Control will be regularly held at the East Hartford Center School. Some of the subjects that will be conducted by the key men in their respective fields are: management of QC; precision thread gaging; optical gaging; nondestructive testing; latest inspection equipment; and the last session will be a panel discussion citing the use of statistics and instrumentation in QC.

MINNESOTA The section is again sponsoring a training course in quality control similar to the one held last year. The time has not been definitely set at present but it will take place early in 1956. The committee in charge is doing all possible to make the course as instructive as last year, and plans to have it cover more advanced techniques. All indications are that it will be bigger and better attended than in the past. Last year the registration compelled the committee to hold two sets of classes to take care of those who attended.

UTICA Last year's successful basic quality control course will be repeated, followed by intermediate and advanced techniques of control of quality through statistical methods. The courses will be devoted mainly to the "hows and whys" of methods without too much detailed theory.

MIDDLE ATLANTIC CONFERENCE—AIRCRAFT DIVISION MEETING The 1956 Middle Atlantic Conference and Aircraft Division Meeting will be in Washington, D. C. at the Shoreham Hotel, Feb. 10-11. The conference is being sponsored by fourteen sections of districts 3, 5 and 6 and the Aircraft Division.

Four concurrent series will be offered in the areas of education, industrial applications, administrative applications and applications specific to the aircraft industry.

Subjects dealt with in the educational series will be: use of training aids, SQC training techniques, use of mid-range and median charts, alternatives to the analysis of variance, advantages and limitations in the use of the range, characteristics of the control chart for fraction defective, and quality control—from laboratory through production.

Subjects discussed in the industrial applications panel will include: applying the standard chi square significance tests to plant problems, fundamental concepts and purposes of specifications, statistics underlying the development of a procurement plan for the joint armed forces, statistics in the physical sciences, use of sensory test panels in controlling quality, continuous sampling, controlling quality for short runs, process control through frequency distributions, and aspects of process capability studies.

Areas covered by the administrative applications panel include: how the quality control engineer can use operations research, statistical techniques in the office, controlling inventory and production in the face of uncertain sales, sampling applied to accounting problems, settling inter-company accounts on a sampling basis, probability sampling, and work sampling. One of the high lights in this series will be a panel discussion concerning "Quality control experience in other countries."

Of utmost interest will be the series of sessions devoted solely to the application of quality control to problems of the aircraft industry. Subjects discussed will concern; quality control without a paper work empire, reliability—what it is and how it can be practically approached, estimating inspection costs, rework and scrap control in terms production can understand, and surveillance inspection and requirements for the contractor.

Each of the four concurrent series will have at least one open forum type of panel discussion with the usual informative question and answer sessions.

Of particular interest to the wives will be the attractive Ladies Program. Planned activities include: luncheons, a fashion show, sight seeing in the nation's capital, a musicale and tour of the White House.

The versatility of the program, the wonderful activities planned for the ladies, the excellent facilities of the Shoreham Hotel and the beautiful city of Washington, all add up to a conference you do not want to miss.

It is suggested that those who are traveling south to attend the textile quality control conference in Charlottesville, Va., Feb. 13-15, start out several days early and stop in Washington for the 1956 Middle Atlantic conference and a pleasant week end before proceeding on to Charlottesville.

For further information write: 1956 Middle Atlantic Conference—ASQC, 921 17th Street N.W., Washington 6, D. C.

STATISTICS SHORT COURSE INDUSTRY AND PHYSICAL SCIENCES

The Institute of Statistics at North Carolina is sponsoring a seven day intensive short course in statistical methods for research workers in industry and physical sciences starting Feb. 12 and running daily through Feb. 18. Three lecture series will be given: one on elementary statistical analysis; one on regression analysis; and the third on experimental design. Guest lectures will include W. G. Cochran, The Johns Hopkins University; S. L. Crump, University of Rochester; and J. S. Hunter, American Cyanamid Co.

A registration fee of $100.00 will be charged and enrollment will be limited to the first 50 applicants. For further information write to Institute of Statistics, North Carolina State College, Box 5457, Raleigh, North Carolina.

EXECUTIVE DEVELOPMENT COURSE

The fourth annual executive development course sponsored by the A & M College of Texas is to be offered on the campus during the three-week period Jan. 29 to Feb. 18. The course is designed to serve the region's rapidly expanding business and industry in developing middle-group and top executives. It aims to broaden the individual viewpoint for comprehensive understanding of business organization as a whole and its place in the economy of the community, state, and nation. Leading educators and outstanding executives from business and industry will be directing programs for developing executive thinking among the men who enroll.

Address further inquiries to Executive Development Course, Agricultural and Mechanical College of Texas, College Station, Texas.

If you think you're indispensible, stick your finger in a bowl of water and notice the hole it leaves when you pull it out.

"FOR MANY ARE CALLED, BUT FEW ARE . . ."

CHICAGO The officers for the newly organized Calumet sub-group of the Chicago section for the 1955-56 term are: chairman, Prof. Nicholas Relich, Purdue University Extension; vice chairman, Marshall Minter, American Steel Foundries; secretary-treasurer, Edgar Ellis, Cities Service Oil Co.

DENVER The officers handling the affairs of the Denver section are: president, Elroy J. Flaten, Rocky Mountain Arsenal; vice president, Loren L. Straw, United Air Lines; and secretary-treasurer, Jack A. Schulz, Dow Chemical Co.

DIVISIONS

Electronics Division

As of July 1, the electronics technical committee of ASQC became the electronics division of ASQC. This change permits wider participation of ASQC members interested in electronics in society activities. The transition cannot be effective without the active participation of the members of the division. As a committee, a small group of people would meet and discuss problems common to the electronics industry and quality control procedures. A resistor and capacitor quality standard was developed and program material for the annual

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conventions provided. The committee also worked in coordination with the IRE to promote the reliability conference in New York during 1954. The division is co-sponsoring the 1956 reliability symposium in Washington, D.C., Jan. 9-10 with the IRE.

The councilors and officers will meet during the year and plan activities to serve the membership. Your suggestions will help us in serving you.

MEMBERSHIP CORNER

Any of us who have ever been connected with a membership drive in any organization know that new members are extremely important, but at the same time we recognize the fact that growth and expansion cannot be the result unless we can manage to hold onto our old members as well. About this time of the year, all of our membership committees become more and more concerned with the list of old members who have not renewed—members who have lost their renewal slip or have simply neglected to take the time required to mail it. The membership committee of the Dallas-Fort Worth section is certainly aware of this problem and since each member of this committee is a good QC man, you can know that corrective action of some sort is inevitable. The corrective action taken by the Dallas-Fort Worth section is somewhat the same as most any section would take and that is

- To have the secretary announce the status of renewals, new members and non-renewals at the regular section meeting. This simply serves to let the membership know where we stand plus the reminder which is indirectly given to the non-renewal who might be in attendance.

- Postal card mailings to all non-renewals. This post card simply serves as a reminder to the non-renewal that he no doubt has over-looked the mailing of his renewal slip. This card also carefully explains why ASQC needs him and why he needs ASQC.

- There is one approach used in Texas which might be a bit uncommon in other parts of the country and that is the use of personal contact—mostly by telephone. A telephone committee is appointed and given names and telephone numbers of not only non-renewals but prospective new members as well. Contact is then made with each listed individual either by telephone or in person. There is no doubt in our minds that this method is equal to or better than any of the other approaches which might be taken since not only is the percent yield high, but this method also contributes no small amount toward the development of new acquaintances and a higher degree of friendliness in general throughout the section.

- People naturally want to know what they might expect to gain personally from membership in our section of ASQC. Therefore, we publish and distribute throughout the membership the established program for the year listing the various subjects and speakers, plant tours and clinic sessions. In addition to this listing of the annual program, individual meeting announcements are prepared and distributed throughout the membership and also mailed to various organizations for posting on bulletin boards.

- Last but certainly not least, is the continual emphasis which is placed on the importance of each member of the section being a committee of one to solicit and encourage those people in his own business organization to visit our section meetings. If an individual is truly interested in the ways and means of building a better product or rendering a service of higher quality, then after a visit or two to the regular section meeting he will be looking for the man with the application blank instead of the man with the application blank looking for him.

SIGNIFICANT DIFFERENCES

Congratulations to Jim Mitchell of the Birmingham section who has been promoted to quality control manager of Avondale Mills Co., one of the leading textile manufacturers of the country.

On Oct. 17, Robert Tenney, president of the Wahl-Henius Institute and program chairman of the Chicago section, addressed the National Beer Wholesalers Association at their national convention in Chicago. His topic was "What kind of beer are you selling?" He spoke of how brewers are using statistical quality control techniques to help them produce a quality product.

On Oct. 24 Mr. Tenney spoke to members of the Wilmette Lions Club on "Marketable uniformity in batch operations thru statistical quality control." Interest of the audience resulted in a question and answer period lasting over one hour.

Richard Shaw, former secretary of the Indianapolis section and formerly with Naval Ordnance in Indianapolis, has transferred to the Cleveland section and is now with General Dry Batteries, Inc.

On Oct. 26 Roy B. Cowin, Jr., supervisor of the quality control department of the Kimble Glass Co. and member of the Columbus section, presented a talk to the Ohio State University student chapter of the Society for the Advancement of Management. The subject of Mr. Cowin's talk was "Quality control department—its place and function within an industrial concern."

J. Y. McClure and J. L. Coburn, Convair-Fort Worth Division and members of the Dallas-Fort Worth section, participated in a clinic session presentation at the Oct. 24 meeting of the newly-formed Waco section, Waco, Texas.

Don Broderick, Erie section chairman, will act as moderator at two sessions of the Middle Atlantic conference to be held in February. These sessions will be "Statistics and the physical sciences" featuring W. R. Pabst of the Bureau of Ordnance and a panel group concerning "The use of sensory test panels in process quality control." Panel members will be Mrs. Mavis Carroll, General Foods, Corp., Hoboken, N. J.; Prof. J. A. Bayton, Howard University, Washington, D. C.; Prof. A. Kramer, University of Maryland, College Park, Md.; and Dr. Glenn Burroughs, office of administrator, agricultural marketing service, Department of Agriculture, Washington, D. C.

M. A. Cline of Seagrams Distillers was elected vice chairman of the Louisville Engineering and Scientific

Societies' council. The council is composed of local sections of 24 engineering and scientific societies working together to promote civic, industrial, and technical progress in the Louisville area. Mr. Cline is the Louisville section's five year representative on the council.

R. F. Englegau, Michigan section, has been named director of quality control for Mueller Brass Co., Port Huron. Mr. Englegau was formerly manager of quality control for the same firm.

A number of changes have occurred in job and company affiliations of New Haven section members.

Robert I. Callahan, section chairman, formerly quality control manager of the Revere Corp. of America, Wallingford, Conn., has been promoted to manufacturing manager of that concern. Dan Grove, formerly assistant quality control manager, succeeds Bob as quality control manager. George S. Georgis, Saddoris Award chairman, formerly quality control engineer, is now assistant quality control manager.

Jack Bradshaw, section treasurer, formerly with Bradley Laboratories, Inc., New Haven, is now quality control engineer at Revere Corp. of America.

Al Stolzenberg, section secretary, formerly industrial engineer at Safety Car, Hamden, Conn., is now supervisor of the industrial engineering department at Safety Car.

Herb Somers, formerly superintendent of quality control engineering in the arms and ammunition division of the Olin Matheison Chemical Corp., is now superintendent of industrial engineering in the same division of Olin.

Jack Gillies, a transfer from the Cleveland section, is now superintendent of quality control engineering in the arms and ammunition division of the Olin Matheison Chemical Corp., New Haven.

Gabrial Macare, formerly quality control engineer manager at Clevite Aero Products, Inc., is now quality control manager of that concern. Gabe is education chairman of the section.

Andrew M. Downer, arrangements chairman, formerly chief inspector of Talon, Inc., Hamden, is now project engineer at the Meadville, Pa. plant of Talon, Inc.

Arthur Stein, a U. S. Army Ordnance specialist in ballistic quality control for ten years, has joined Cornell Aeronautical Laboratory, Inc. as principal research engineer in the systems research department. Mr. Stein is a senior member, presently affiliated with the Chicago section. He is also a member of the Institute of Mathematical Statistics, Operations Research Society of America, the American Statistical Association, and the American Ordnance Association.

J. Lundon, Philadelphia section, is now quality manager for the Radio Condensor Co., Camden. He was formerly with Wicks Engineering Co. Other members of the section who have taken on new company affiliations are: Robert Martin, Rheem Mfg. Co., Philadelphia: Carl Siegfried, Ronson Lighter Co., Stroudsburg; Marvin Gottesman, Progress Machine Co., Philadelphia; and W. Clemens, who has transferred to the Hughes Aircraft Co., Tucson, Arizona—Tucson, please note.

R. Shaw Goldthwait has been elected chairman of the New England conference council, and Bill Hammerly takes over Shaw's old job as treasurer of the Rhode Island section.

St. Louis section president Joseph Movshin has again been appointed chairman of the national committee for statistical quality control of the American Institute of Industrial Engineers. Mr. Movshin has also been re-elected as a director for the St. Louis section of the American Institute of Industrial Engineers. Mr. Movshin recently presented a most interesting speech on "Control charts your most valuable tool" at the second annual Cleveland quality control conference.

Robert S. Boyle, former instructor in statistics and quality control, Iowa State College Graduate School, has recently been appointed to the position of research engineer, production data and quality analysis at Convair division of General Dynamics at Pomona. Mr. Boyle was recently elected to senior membership in the San Bernardino section.

The Scranton-Wilkes-Barre section has been honored by the selection of two of its members to appear at the Middle Atlantic conference meeting to be held in Washington, D. C. on Feb. 10. Section chairman Joseph Gallagher will act as moderator at one session while vice chairman Carl Larson will present a paper at a special session.

A. Henry Morgan, of Henry Morgan & Associates, management consultants, Norwalk, Conn., and a member of the University of Bridgeport industrial engineering faculty, will serve as course co-ordinator and moderator for the course on small industry management. This is a ten week course to be given at the University of Bridgeport. The Manufacturers Association of Bridgeport and Small Business Administration are co-sponsors of the

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scheduled conference. The course is designed to help small business help itself. Mr. Morgan is a senior member of the Southern Connecticut section and will instruct on "Product development and profitable production in the small plant through industrial engineering."

The Toronto section extends all the best to its section treasurer M. J. O'Callagham who is now with British American Oil Co.

Paul Russo, Bendix Aviation Corp., Utica, attended a recent ten day intensive training course "Quality control by statistical methods" which was offered by the State University of Iowa at Iowa City.

J. W. "Walt" Fisher, membership chairman for the Wichita section, made a wise choice in the appointment of Lee Wadley as membership committeeman at Cessna Aircraft Co. At the beginning of our current year, Cessna had 23 members in the society. At the present time, Cessna has 71 members. This means that Cessna has 48 new members this year of which 37 were signed up by Mr. Wadley. Approximately half of the new members that Mr. Wadley has signed up are production foremen or assistant production foremen. The section is certainly proud of this achievement. *(Ed. note. So is the society!)*

A new type of service called "Facility Rating" designed to enable industry and business quickly and independently to evaluate the ability of suppliers to perform their obligations, is being offered by Quality Control Engineers, Inc., of Los Angeles, Calif.

On-premise surveys are made by engineering and technical experts who evaluate the whole range of manufacturing processes and techniques, including management abilities.

The directors of the corporation are: Dr. Harry G. Romig, president; Ralph A. Anderson, vice-president and secretary; James P. Whitney, vice-president and treasurer; and Anthony F. Rosso.

In addition to general manufacturing, services are offered in these fields: airlines, automotive, banking, chain stores, constructors, department stores, governmental agencies, hospitals, hotels, petroleum industries, plastics, radio, television, shipping, and transportation.

The new firm is already operating in the western states of Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Washington, and Wyoming. General headquarters are at 6399 Wilshire Boulevard, Los Angeles 48, Calif. with the opening of district offices in New York, Chicago, and Fort Worth soon to be announced.

The Chicago section notes with deepest regret the death of one of its members, Mr. Derrel J. McGinnis. Mr. McGinnis had been a member of our section for three years. He was employed by the Sentinel Radio Corp. as general foreman of the quality control department.

The Toronto section notes with deepest regret the sudden passing of one of its members, T. J. Harris. Mr. Harris had been employed by the IBM Corp., Toronto.

Bibliography

JOSEPH MOVSHIN, *Editor*

Assisted by the Editorial Committee, St. Louis Section, ASQC

BIBLIOGAPHICAL

STATISTICS—SERVANT OF ALL SCIENCES, by Jerzy Neyman

(Science—v. 122, n. 316, 2 Sept. 1955, p. 401-406)

This article reports the first part of the Third Berkeley Symposium on Mathematical Statistics and Probability which was held Dec. 27-30, 1954. These are organized by the Statistical Laboratory, University of California. This article discusses some of the recent works presented in various proceedings and indicates the field in which the papers were written. These include medicine and public health, psychology, astronomy, and industry. Basically, this article is a bibliography of material included in the proceedings of the Berkeley Symposiums.

APPLICATION—ELECTRICAL INDUSTRY

APPLICATIONS OF STATISTICS TO MOTOR TESTING by J. L. Oldenkamp, (General Electric Co.)

(Electrical Engineering—v. 74, n. 8, Aug. 1955, p. 671)

In the testing of fractional horsepower electrical motors, the author points out that there are three basic sources of variation:

1. Variation between motors
2. Bias on the part of the tester
3. Inability to control all test conditions.

In the design of a new motor, a basic problem is to determine how typical the test of a single experimental motor is of the performance of the new design. A series of tests were run of six of each of three types of motor. Each one being tested three times. Essentially analysis of variance was used to develop the desired information. Three components of variance were calculated through this procedure. Error of estimate curves are given showing the variation in percent based on the number of motors tested.

APPLICATION—MISCELLANEOUS

THE APPLICATION OF STATISTICS TO SIMPLE FIXED-GAGE DESIGN, by H. C. Charbonneau (General Motors Institute)

(Transactions of the ASME—v. 77, n. 6, Aug. 1955, p. 949-956)

This article discusses many facets of gage design and the application of statistical methods to other

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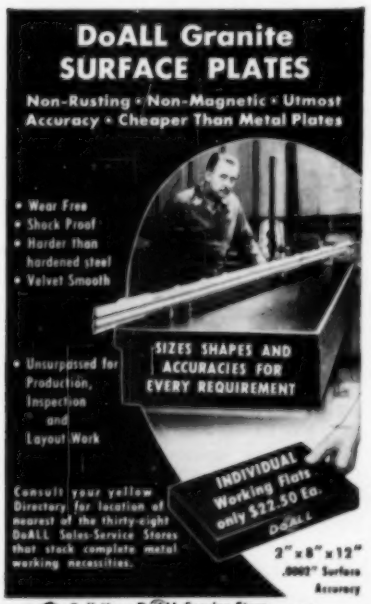
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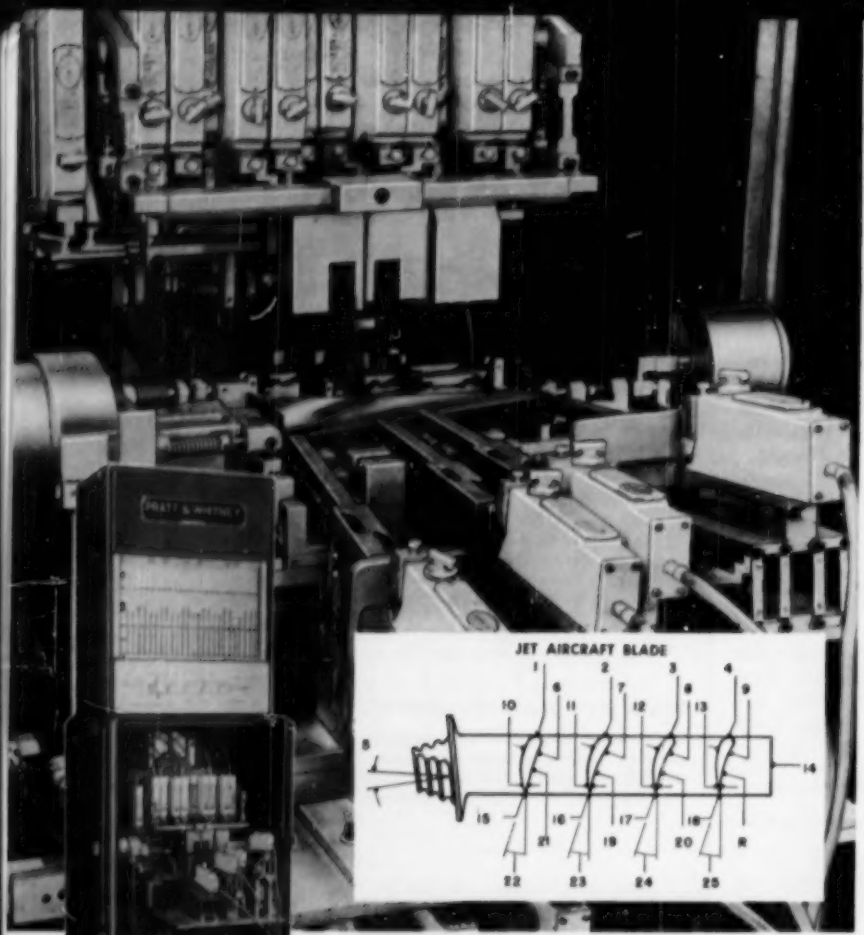

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problems in quality control. The normal curve is introduced along with the use of probability paper. For given gage and allowance tolerances, certain proportions of the normal curve are included or excluded by the gage, depending on the exact dimensions of the gage and the distribution. The application of this concept to unilateral and bilateral tolerances is considered. Using probability paper, the gage tolerance in terms of the proportion included or excluded by the gage may be determined. This is illustrated in terms of cost for different classes of gages. An interesting table showing percentage of parts rejected for various combinations of gage makers tolerance and wear allowances is given. A chart illustrating a cost analysis, considering fixed gage cost, and reinspection cost for various percentages of the material rejected is given.

Selected references in the Bibliography of *Industrial Quality Control* are obtained from the following sources:

The International Statistical Institute, *International Journal of Abstracts on Statistical Methods in Industry.*

SOME PROBLEMS RELATED TO TESTING COLOR VISION WITH THE NAGEL ANOMALOSCOPE, by Ingeborg Schmidt (Journal of the Optical Society of America—v. 45, n. 7, July 1955, p. 514-522)

This article applies several statistical techniques to the analysis of significance of results of comparative tests and to the development of distributions of reaction of individuals to the tests. Basically, the comparison of averages by the t-test to given levels of probability are used. Distribution of percentages on the normal curve are used to determine the portion of individuals in various groups. Test-retest reliability was also investigated by the F ratio with analysis of variance.

ENGINEERING AND EXPERIMENTS

THE CALCULATED RISK IN FLOOD CONTROL, by E. J. Gumbel Columbia University) (Applied Scientific Research—Section A, v. 5, 1955, 273-280)

This paper presents a discussion of the application of the calculated risk concept as a replacement for the arbitrary safety factors used

in engineering and actuarial calculations. Basically, the risk involved must be balanced against the cost. Basic statistics to approach this problem are developed and a calculated risk and design quotient for a given probability are described. This concept is then applied to flood problems as an illustration. A chart showing the relationship between design duration, probability of failure, and return period for this type of problem is also given.

MISCELLANEOUS

QUALITY CONTROL AS APPLIED IN WEST COAST BUMPER PLANT, by Frank G. Fisher (Automotive Industries—v. 113, n. 8, Oct. 15, 1955, p. 66-68)

This article discusses the rigid inspection procedures utilized in the production of bumpers at the Rheem Automotive Company at Los Angeles.

SAMPLING PLANS AND RELATED TOPICS

DISCOVERY SAMPLING—AN INSPECTION TOOL (Metal-Working—v. 11, n. 11, Nov. 1955, p. 36)

This brief abstract describes discovery sampling. It presents this technique as considering the probability of occurrence of a partially defective lot along with the probability that a sampling plan will accept the lot.

THEORY AND APPLICATION—GENERAL

STATISTICAL THEORY AND RESEARCH DESIGN, by Lyle V. Jones (University of Chicago) (Annual Review of Psychology—v. 6, 1955, p. 405)

In the past few years there has been quite an increased interest in, and large numbers of articles on statistical methods and their application in the field of psychology. This is due in some measure to new techniques developed, as well as from limitations that have been recently learned with regards to the older techniques. Many of the new approaches are discussed in quite some detail. These include:

Estimates and tests of proportions
Estimates and tests of means
Estimates and tests of variances
Measures of average
Survey sampling
Psychometric scaling
Classification and test theory
Factor analysis

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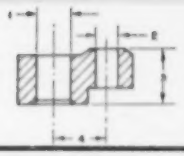
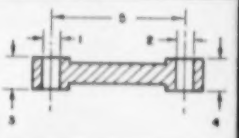


SMALL CONNECTING ROD



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STATISTICS

ON A CLASS OF DECISION PROCEDURES FOR RANKING MEANS OF NORMAL POPULATIONS by K. C. Seal (University of North Carolina)
(The Annals of Mathematical Statistics—v. 26, n. 3, Sept. 1955, p. 387-398)

ORDERED FAMILIES OF DISTRIBUTIONS, by E. L. Lehmann (University of California, Berkeley)
(The Annals of Mathematical Statistics—v. 26, n. 3, Sept. 1955, p. 399-419)

URN MODELS OF CORRELATION, by J. A. McFadden
(The Annals of Mathematical Statistics—v. 26, n. 3, Sept. 1955, p. 478-489)

STATISTICS AND SUBFIELDS, by R. R. Bahadur
(The Annals of Mathematical Statistics—v. 26, n. 3, Sept. 1955, p. 490-497)

OPERATIONS RESEARCH

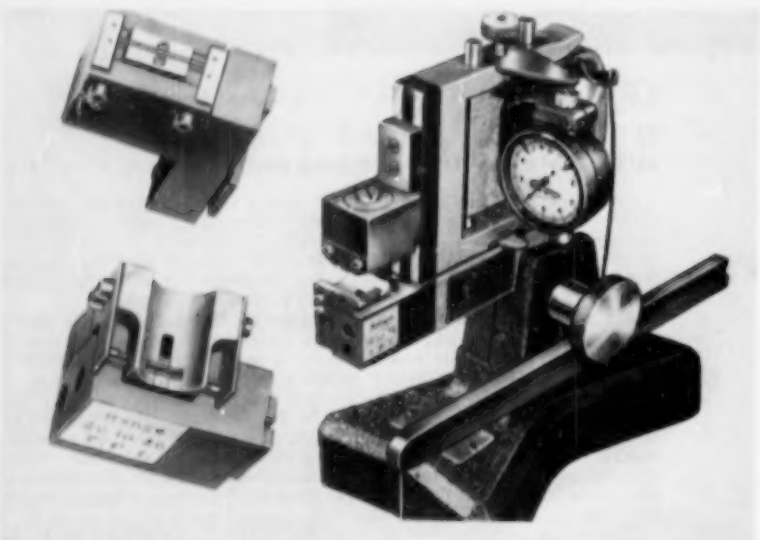
DESIGNING FOR A SPECIFIC MISSION, by R. P. Buschmann (Lockheed Aircraft Corp.)
SAE Journal—v. 63, n. 10, Oct. 1955, p. 30-32)

This article discusses a simplified, largely graphical analysis considering various factors and their effect on the accomplishment of a definite objective. The discussion is based upon an aircraft design problem from the military standpoint as well as from a commercial standpoint. Various charts are used to indicate the relationships between the various factors so that the design providing the best overall ability to accomplish the objective can be selected. It is basically a simplified operations research approach to select the optimum condition considering numerous factors.

What's New?

ROY A. WYLIE, *Editor*

When inquiring about "What's New?" items, please mention INDUSTRIAL QUALITY CONTROL.



An instrument for the measurement of pitch diameter of threads and another for lead checking are announced by **Standard Gage Co., Inc.**, Poughkeepsie, N. Y. Both gages utilize the Versa-Dial gage as the fundamental unit. Measurement of pitch diameter is basically by the three-wire method, but with holder devices of such design that the operator of the gage need not be aware of the wires themselves. Upper wire is approximately positioned by two plungers, which automatically recede under the effect of the gaging action. Lower wires are separated slightly by collars but limited as to maximum spacing. Wires are of tungsten carbide for most pitches. Measuring pressure is adjustable but remains constant for a particular setting. Six sets of interchangeable jaws cover a range from 56 to ten threads per inch and diameters up to one inch. The gage is regularly furnished with a dial indicator graduated in 0.0001 inches. The lead checker utilizes jaws carrying "V" edges and capable of being attached at any desired spacing. Setting is facilitated by a fine adjustment screw. A spring-loaded lever snugs the workpiece against the Vees, and the lead variation is read directly on the indicator due to the parallel sliding action of the basic Versa-Dial unit. Jaws regularly stocked are suitable for pitches from ten to 40 threads per inch and diameters up to one inch for American National and Unified Threads. Jaws for finer or coarser threads can be furnished as specials. The lead checker is supplied with an indicator graduated in 0.0001 inches.

★ ★ ★

William J. Hacker & Co., Inc., 82 Beaver St., New York 5, N. Y. are distributing the "Lanameter"—a projection microscope designed specifically for the measurement and analysis of wool fibers. Tests performed with this instrument conform to international standards for the measurement of wool fibers. The "Lanameter" consists of a microscope, a light source and a viewing screen which are combined into a single unit. The specimen is placed on a mechanical stage and brought into focus. The microscopic image appearing on the screen of the instrument is magnified 75x to 500x. For the measurement of fibers, a sliding, rotatable, transparent scale is provided.

★ ★ ★

Federal Products Corp., 1144 Eddy Street, Providence 1, R. I., has designed a special gage to check parallelism of two bores in two planes simultaneously. The basic instrument is a dual Dimensionair Air Gage equipped with special tooling. To establish a common axis for the two bores, expanding precision mandrels are placed in each bore and in turn rest in V-blocks. The gaging contacts are mounted on frictionless motion transfer units which relay the movement of the sensitive contacts to Federal AirProbes and to the Dimensionair Air Gage. One contact checks the position of the front of the reference mandrel and another sensitive contact locates on the underside to check in the other plane. The dials of the Dimensionair units immediately show whether the two bores are parallel in both planes. By checking the parallelism in two planes simultaneously, considerable inspection time is saved.

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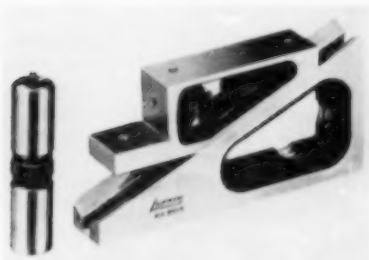

Two new models of Planer Gages with one inch wide bases have been announced by **The Lufkin Rule Co.**, Saginaw, Mich. Both gages have increased capacity (up to 10¾ inches with extensions) and a new plumb level for using the gage on end. The gages also feature a rapid adjustment locking device for quick positioning of the gage and a fine adjustment for final, precise setting. Both gages are available with three inch extension in a fitted mahogany case or in sets which include both one inch and three inch extensions, a straight scriber, an offset scriber and gage extension, and a scriber holding attachment.

★ ★ ★

Permapex, a new type crayon, combining permanence with removability, has been announced by the **Apex Permanent Crayon Co.**, 235 Lora Ave., Youngstown 4, Ohio. This crayon allows carefully constructed graphs, charts and diagrams to remain on most surfaces indefinitely. Fluctuating figures or other elements may be drawn in with chalk and washed off without damage to the basic chart. When the project has been completed or the chart is no longer required, crayon markings are easily removed with Apex-Removo, a special solvent provided by the manufacturer. The Permapex Kit consists of four Apex-Permanent Crayons—Red, White, Yellow and Blue—plus a large tube of Apex-Removo. Single kits list at $3.25 each and quantity prices are available.

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8803 Lyndon Ave. Detroit 38, Mich.

The **Bausch & Lomb Optical Co.**, 625 St. Paul St., Rochester, N. Y., have developed a new type hand comparator for quickly checking surface roughness. The surface comparator permits metal surfaces to be compared with a selected standard for roughness under 10-power magnification. The pocket-sized, hand-held instrument operates on a unique optical principle which greatly emphasizes surface irregularities. It illuminates both the known standard and the piece under study. When looking into the 10-power eyepiece, the user sees a circular image, one half of which is the standard, the other half the sample being checked. A comparison can thus be made quickly using commercial roughness standard strips, or samples of satisfactory work. The Bausch & Lomb instrument is expected to aid quality control inspectors by filling the gap between precise measurement with a Profilometer and the "thumbnail" method so widely used. The complete instrument will be sold through industrial supply houses for $30.

★ ★ ★

Micrometrical Development Corp., 2821 S. State St., Ann Arbor, Mich., announces the new Proficorder—a mechanical-electronic instrument that provides a magnified chart record of the profile of internal and external machined and finished surfaces. This instrument records (1) waviness, bows, steps and other widely-spaced irregularities, with surface roughness omitted, (2) roughness irregularities alone, with waviness omitted, or (3) the combined roughness and waviness profile. Selection of the characteristic to be charted is made by push buttons on the control panel. The charts show the true height and spacing of the surface irregularities. In addition, a meter on the control panel shows the average height of the roughness profile being recorded. This Proficorder includes a Tracer, a Pilotor, and an Amplicorder. All working parts are mounted on or in a desk-type console. The piece being profiled is placed on the Pilotor base plate and the piloting mechanism moves the Tracer in a plane parallel to the work surface at 0.005 inches per second, over any desired length of trace from 1/16 to 1½ inches. The Tracer is a differential-transformer-type transducer. It has a stylus with a diamond tip of 0.0005 or 0.0001 inch radius which moves along the surface. The output voltage of the Tracer is modulated in accordance with the vertical position of the stylus. After amplification this voltage operates the pen meter of a recorder in the lower drawer of the console, so that the amount of pen movement is proportional to the vertical displacement of the Tracer tip. Six vertical magnifications are provided from 0.000025 to 0.0005 inches per chart paper division (approximately 10,000x to 500x,) and are selected by push buttons on the control panel. A gear shift lever on the recorder chart drive provides seven horizontal magnifications, from 0.001 to 0.100 inches per chart paper division—approximately 500x to 5x. Detail specifications are available on request from the manufacturer.

★ ★ ★

Chicago Apparatus Co., 1735 N. Ashland Ave., Chicago 22, Ill., have announced that as a result of widespread cooperation on the part of industry, Chicago Apparatus is now able to supply more than 1,500 organic chemicals on demand. Some

industries use organic chemicals regularly but most use them infrequently and cannot anticipate their needs. When the need does arise, however, it is acute. A few years ago such chemicals were manufactured in limited quantities, and some varieties were produced infrequently. Stocks were hard to get, deliveries were uncertain and dealers could not afford to carry them because of limited scattered demand. At that time the Chicago Apparatus Co. received assurances from many companies that they would buy such supplies from a reliable source if they were available. Therefore, Chicago Apparatus began to stock organic chemicals in quantity and inventory was planned to meet customers' needs. They now claim to have the largest stock of organic chemicals in the Midwest.

★ ★ ★

A new type of mechanics loupe is now being manufactured by the **Englass Co., Inc.,** 57 Shady Way, Rochester 16, N. Y. This loupe features a thumb screw clamping arrangement which allows it to be used as a magnifier with height gages, center-mikes, slide rules and other types of inspection instruments. The loupe may also be attached to any type of stand or holder, as well as to spectacle frames.

★ ★ ★

Franklin Electronics, Inc., 415 West Pike St., Philadelphia 40, Pa., announce the Sound Spectrograph for analyzing complex sounds in three dimensions. Frequencies of 50 to 7000 cycles per second and their relative amplitudes are simultaneously shown on a common time base. Readings are made on a 6 x 12 inch paper chart. The Sound Spectrograph also portrays a bi-dimensional picture of frequency versus amplitude at any instant in time shown on the tri-dimensional analysis. Audio frequency analysis can be made directly from standard reels of magnetic tape. Because of the tri-dimensional presentation of the instrument, new areas of study of sound characteristics are made available to research in the fields of industrial inspection and testing, acoustics, electronics and medicine.

★ ★ ★

POSITIONS WANTED

Address all replies to box number references to: American Society for Quality Control Room 563, 50 Church Street, New York 7, N. Y.

QUALITY CONTROL SUPERVISOR five years experience in statistical quality control and inspection supervision. College graduate, married, 30 yrs. of age. Resume sent on request. Salary requirements $7000. New England area only. Please reply to Box 12F1 at the above address.

EXPERIENCED QUALITY MANAGER desires responsible position directing inspection or quality control function. Fifteen years experience in high level responsibility for organizing and directing inspection and quality control departments. Successful in applying SQC to industrial problems. Many years of close contact with Armed Service Inspection Agencies. Please reply to Box 12F2 at the above address.

QUALITY ADMINISTRATOR—Successful record as organizer and administrator of quality assurance, systems reliability and statistical quality control programs. Four years chief electrical engineer with electric motor manufacturer; 5 years chief of quality assurance with outstanding manufacturer of precision electromechanical and electronic devices. Registered porfessional engineer; 42 years old; presently employed. Desire Southern California or Florida location, preferably small or medium-sized company. Please reply to Box 12F3 at the above address.

POSITIONS AVAILABLE

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ABSTRACTOR, free lance, for articles in the field of applied statistics. Foreign languages helpful. Please give qualifications, experience and language ability. Please reply to Box 12T1 at the above address.

PAPER MANUFACTURER has attractive opening in New Jersey for mathematics graduate, preferably with quality control training. Will work as QC engineer in sizeable paper mill, developing and maintaining a full quality control program including raw material control, process control, product control, and special studies. Must be self-starter with initiative and ability to work with others. Please reply to Box 12T2 at the above address.

QUALITY CONTROL ENGINEER Mid-West manufacturer of nutritional and pharmaceutical products requires graduate quality control engineer between the ages of 28-35. College degree in mechanical or industrial engineering or statistics with study in quality control theory and procedures required. Three years experience and installing and applying statistical methods to receiving and production inspection desired. Previous experience in organization of a statistical quality control program desirable. State educational background, experience and salary required in resume. Please reply to Box 12T3 at the above address.

QUALITY CONTROL ENGINEER and STATISTICIAN are needed for expanding Eastern aluminum extrusion operations. Challenging opportunity to initiate and apply QC methods in growing field. Individuals selected must be capable of advancement. Experience in industrial quality control methods necessary with background in metal working industry desired. Please give personal and educational data, work history, experience, past earnings and salary requirements in reply to Box 12T4 at the above address.

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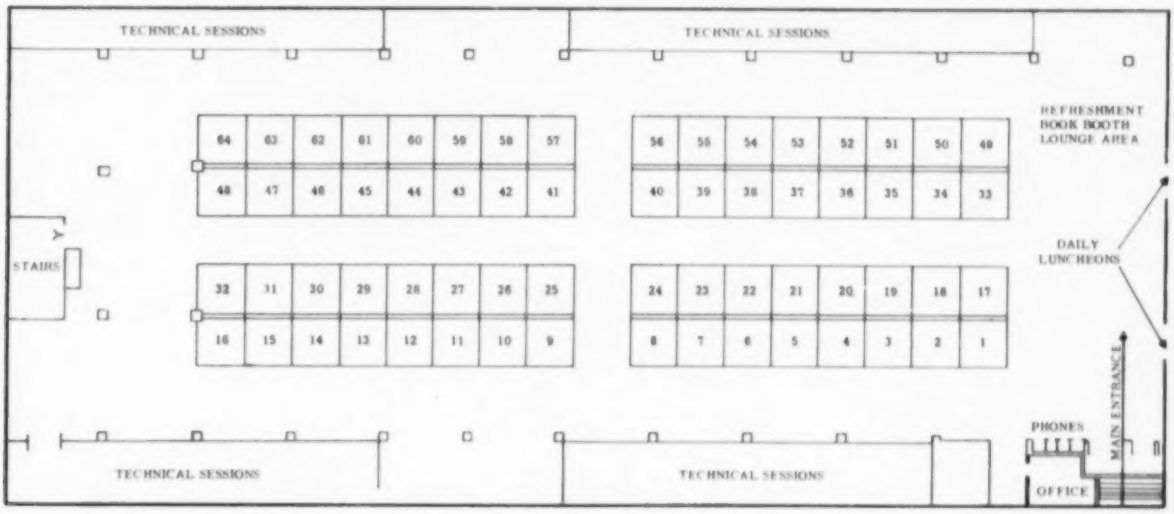
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RATES FOR BOOTH SPACE

All Booths are 10 feet by 10 feet

Booth	Price	Booth	Price	Booth	Price
1	$300	23	$225	45	$225
2	250	24	300	46	225
3	250	25	300	47	225
4	250	26	225	48	275
5	250	27	225	49	300
6	250	28	225	50	250
7	250	29	225	51	250
8	300	30	225	52	250
9	300	31	225	53	250
10	250	32	275	54	250
11	250	33	300	55	250
12	250	34	225	56	300
13	250	35	225	57	300
14	250	36	225	58	250
15	250	37	225	59	250
16	275	38	225	60	250
17	300	39	225	61	250
18	225	40	300	62	250
19	225	41	300	63	250
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DESIGNED INTO THE PRODUCT

Control

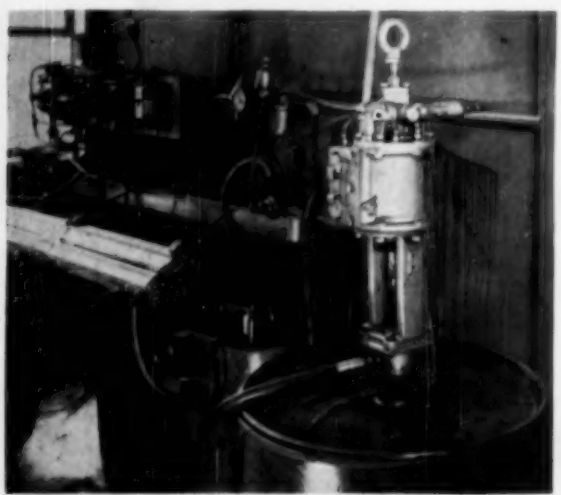
ENGINEERED INTO THE PROCESS . . .

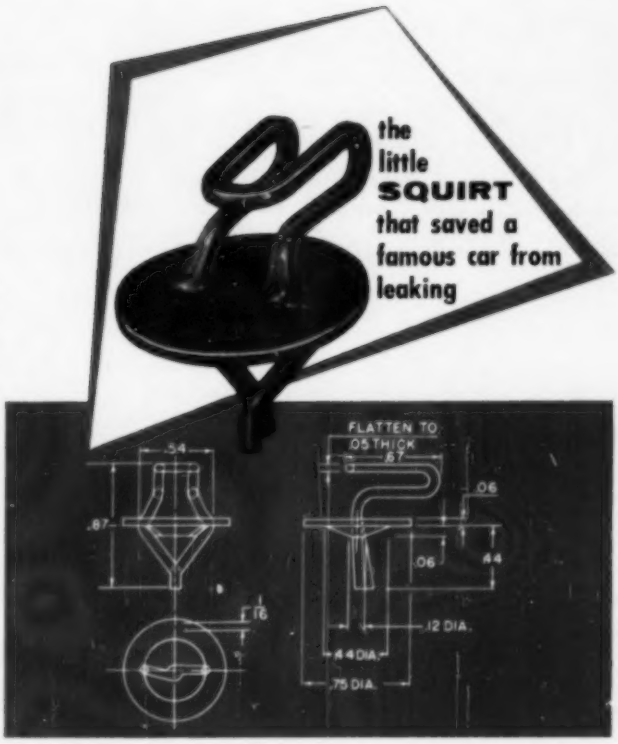
is a highly developed and standard procedure applied to the many and varied products manufactured by Mattatuck. For example, just a little squirt of exactly the right plastic . . . in just the right place . . . makes this clip a unique headache-saver for one of the "Big Three."

Here's the story. In every car, many of these clips are used to hold interior trim panels in place. Past practice was to "dum-dum" the holes by hand for waterproofing and then insert the clips . . . a time-consuming operation that produced poor quality results and many complaints from the field.

Mattatuck was asked to manufacture a clip which would be dependably self-sealing . . . save the "dum-dum" operation . . . yet meet always-tight cost limitations and quality requirements of the automotive business. This little clip was featured in the first issue of "Goezintos in the News," a Mattatuck product news service.

Wire clip forms themselves are made on four-slide machines, ingeniously tooled with a special auxiliary air-operated flattening station as well as with 8 separate and distinct motions of the slides in each cycle. Production is better than one clip per second. Clips are then





hardened, tempered, phosphate-coated, and black-japanned . . . ready for use.

Routine approaches to the problem of "gasketing" these clips obviously wouldn't work. Mattatuck engineers, already experienced in the possibilities of the newer plastics, finally designed and built the production conveyor shown in the photograph, which directs a "little squirt" of liquid polyvinyl chloride plastic called Chem-o-sol (Chemical Products Corporation) at just the right spot on each clip as it passes by. The little pool of liquid forms completely around the legs of the clip, closing all openings, and then passes through a precisely controlled curing and drying cycle to become a soft, watertight collar. Spring pressure of the clip when snapped into place results in a perfectly watertight "gasket" in a fraction of previous assembly and "dum-dum" time.

Production? Now in excess of a million pieces a month. Cost? Less than 1¢ apiece complete.

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Goezintos

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